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Attention may also be drawn to the "Bulletin of the Imperial Institute," published quarterly, which contains records of the investigations conducted at the Imperial Institute, and special articles on tropical agriculture and the commercial and industrial uses of vegetable and mineral products. Copies of this publication, price 4s. 4d. per annum (including postage), may be ordered through "The Argosy" Company, Limited.

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SUBSCRIPTIONS TO "THE JOURNAL"

A number of complaints have been received, particularly from the country districts, that would-be readers of "The Journal" are unable to obtain copies. Our system of distribution has been made as complete as possible, but the demand at many centres has so exceeded the supply that some disappointment has been inevitable. We would point out, however, that by the simple method of

SUBSCRIPTION

all inconvenience can be avoided. The sum of

FOUR PENCE

remitted to

The Assistant Director of
Science and Agriculture,
Botanic Gardens,
Georgetown,

will ensure the delivery of one volume (four numbers) of "The Journal," post free, for one year. This method is earnestly commended to all our readers, present and prospective.

Lands and Mines Notice.

Under Crown Lands Regulations.

NOTICE.

SELLING PRICE OF CROWN LAND.

AS required by Clause 24 of the Crown Lands Regulations, 1910, notice is hereby given that His Excellency the Governor has been pleased to fix the price at which Crown Land in the colony shall ordinarily be sold as follows .—

For areas up to 100 acres at $1.00 per acre.

For each acre over 100 acres and up to 250 acres at 75c. per acre.

For each acre over 250 acres up to 500 acres at 60c. per acre.

These prices to include all costs of Survey and preparation of title, etc.

The Governor, however, reserves to himself the right to make grants of land in excess of 500 acres on special conditions as to purchase, in cases where the applicants can advance satisfactory proof as to the capital to be invested and their ability to beneficially occupy the land.

FRANK FOWLER,
Commissoner of Lands and Mines.

Department of Lands and Mines.
1st April, 1910.

Terms and Conditions on which Crown Lands in British Guiana can be obtained for the Cultivation of Rubber under the Crown Lands Regulations, 1910.

(1.) The Governor may grant leases of areas of land of any size for the purpose of cultivating rubber thereon for a term of ninety-nine years subject to the following terms and conditions:—

(*a.*) No rent shall be payable during the first ten years of the lease but the lessee shall pay an annual rent of twenty cents an acre from the eleventh to the fifteenth year inclusive, and an annual rent of fifty cents an acre during the remainder of the lease, and in default of payment of such rent on the day on which the same is due, the lessee shall in addition pay interest thereon at the rate of six per centum per annum for each day of such default.

(*b.*) During the first ten years of the lease the lessee shall pay the sum of two cents a pound for all rubber, balata, or other substances of the like nature obtained by him from the land, whether from indigenous or cultivated trees.

(*c.*) The lessee shall each year plant one-twenty-fifth part of the land leased with rubber trees, with an average of not less than sixty rubber trees to each acre, until he has so planted not less than ten-twenty-fifth parts of the said land and shall maintain such cultivation in good order to the satisfaction of the Governor-in-Council.

(*d.*) In clearing the said land for cultivation no rubber tree or bullet tree shall be destroyed without the permission in writing of the Commissioner.

(*e.*) The lessee shall not transfer his interest in the land leased or any part thereof, save with the permission of the Governor-in-Council, but such permission shall not be unreasonably withheld.

(*f.*) If the lessee employs Aboriginal Indians, he shall keep on the tract a book, which shall be open at all times to the inspection of the Protector of Indians, the Magistrate of the District, and of any officer of the Department, Commissary of Taxation, or Officer of the Police Force and in which shall be regularly entered the name and tribe of every such Aboriginal Indian, the rate of wages allowed, and the amount paid; and all such wages shall be paid in money except with the sanction in writing (which may be either special or general) of the Protector of Indians and shall be paid (as the labourer may desire) either weekly or at the expiration of his contract, or part weekly and the remainder at the expiration of his contract;

(*g.*) The lessee shall not give or deliver to any Aboriginal Indian any spirituous liquor as an equivalent for, or in payment of, wages or for any work or labour done or performed for him by such Aboriginal Indian.

h.) The lessee shall place and keep on the façade of the land leased on or near to each boundary paal, a board or tablet on which shall be painted in plain legible letters and figures the name of the lessee, the length of the façade, the compass bearings and depth of the side-lines of the

land, and the number and date of the lease under which he holds it; and the lessee shall keep such board or tablet with such inscription in good repair during the continuance of the lease; and he shall also keep the boundary lines of the land so far as he has cultivated or beneficially occupied it clear and open at all times to the inspection and reasonable satisfaction of any officer of the Department of Lands and Mines.

(*i.*) The land leased shall be subject to the right of way across any portion of it to the Crown lands aback of the said land for the officers and servants of the Crown and Government of the Colony and others thereto authorized by the Crown or Government.

(*j.*) The lease shall not confer on the holder any right to take or obtain mineral oil from any deposit that may exist in or under the land leased and all officers of the Crown or Government and other persons thereto specially authorized by the Government shall at all times have the right to enter such lands for the purpose of obtaining mineral oil therefrom: provided that the lessee shall have the right to compensation for any damage suffered by him in consequence of such entry and the obtaining of mineral oil from the said lands.

(*k.*) If the lessee pays the rent reserved and observes and performs all the covenants and conditions contained in the lease, he shall and may peaceably and quietly possess and enjoy the land leased without any interruption by the Crown or any person lawfully or equitably claiming from or under the Crown.

(2.) If any of the said terms and conditions are not complied with, or the rent is not paid, within fifteen days of the same becoming due, the Commissioner shall have the right to re-enter the land leased and take possession of the same, without paying compensation for buildings or machinery erected by the lessee on the said land.

(3.) If all the terms and conditions of the lease have been complied with, the lessee shall have the right, at any time after the expiration of ten years from the date of the lease, to purchase the land leased at the price of four dollars an acre, and on payment of the said price an absolute grant of the said land shall be made to him, and from the date of such grant the said land shall without exception be in the same position and subject to the same laws and regulations as private lands.

(4.) The fees payable for obtaining a lease, which must be deposited with the application are as follows:

	$ c.
Application	5 00
Survey—	
Areas up to 500 acres—per acre ..	30
Each acre above 500 and up to 1,000	20
Each acre above 1,000	10
These charges include labour, cutting lines, etc.	
Cost of drawing up, executing and stamping lease in Registrar's Office, say	16 20

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Directions to Correspondents.

Notice.—Letters should preferably be written on one side of the paper only, and as far as possible, each letter should deal with one subject only, to allow of its being referred to the officer who is concerned with the subject.

Officers should be addressed by their titles, not by their names, to prevent confusion with private letters and to ensure that official letters are opened in their absence.

Letters should be addressed—according to the nature of their contents and the business dealt with —to either

The Director,
Department of Science and Agriculture,
Broad Street,
Georgetown.

or

The Government Botanist,
The Botanic Gardens,
Georgetown.

If to

The Editor,
The Journal of the Board of Agriculture,
or the Economic Biologist.

or

The Secretary of the Board of Agriculture,

letters should be addressed to
Broad Street,
Georgetown.

Parcels should always contain the name of the sender. If this is not done, it is often impossible to tell from whom they come, in the case of several arriving at the same time.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. V. JULY, 1911. No. 1

The Agricultural & Hygiene Lectures.

In order to concentrate effort and economise in other directions, the lectures to teachers on Agricultural Science and Hygiene to be held this year in Georgetown have been so arranged that three-quarters of the course will be given in August, leaving only one week's lecturing before Christmas—a time which has proved awkward for the teachers by reason of its being so near the January examinations. This number of the *Journal* should appear when the course is in full swing, and the occasion seems opportune to revert to the object and scope of the lectures, concerning which some haziness seems to exist.

So far as the 'agricultural' portion is concerned, the syllabus has been framed with the object (broadly stated) of ascertaining "what a plant is and how it grows." The idea is not to teach Physics or Chemistry or Botany, but to consider such parts of those vast sciences as bear directly upon the plant and its environment and throw light upon its anatomy and physiology. The method adopted by the lecturer is one which has been adequately discussed by the Department of Science and Agriculture and has been considered well suited to the conditions obtaining in British Guiana. Wherever possible everything is made frankly local. The student is not concerned with anything but the colony plants (and familiar ones at that) and colony conditions. In matters of Hygiene this last applies with especial force. The examination after the course is conducted not by a "foreigner" but by a local official well acquainted with the conditions aforesaid and in sympathy with the examinees and their difficulties. His reports and recommendations are available for the guidance of the lecturer, who is thus furnished with an invaluable check on the past and a practical guide for the future.

Examining the syllabus a little more closely, it is clear that, so far as the physical and chemical portion is concerned, the experiments performed by the lecturer must be mainly illustrative. They can seldom be repeated by the student, who has neither the apparatus nor the necessary conveniences. Even the lecturer is somewhat handicapped at New Amsterdam, where a fully equipped lecture counter with a gas supply is not available. The lack limits the scope and effectiveness of the experiments in some directions, and is a great thief of time. The difficulty is unavoidable, and is, moreover, of small moment. The best opinion of the day agrees that scientific method is easiest taught from the biological, and especially from the botanical, side rather than from the chemical. All science is based primarily on observation and experiment, and it is upon the botanical part of the course that the lecturer depends for introducing his audience to scientific principles. Observation first, the careful taking of notes of these observations second, classification third, interpretation and theory last, and everything based upon, referred to and checked by actual experiment: such is "scientific method" in a nutshell. But observation comes first and foremost. It is an easy thing to do a chemical experiment: it is a much harder thing to *see* all that happens. It requires training; and for sound training of the eyes to see, nothing can beat botany. In chemistry the new student is often misled by the manipulation and confused by strange names; plants are familiar things, and their examination needs but a pair of sharp eyes and a sharp knife. The former is the birthright of the great majority of natives of British Guiana: the latter is not expensive to acquire. Furnished with these, the tyro may make a start *on the first plant that comes to hand.* We underline that. No matter what the specimen may be, whether it is included in a "course" or not, its careful examination will give rise to a host of questions which must lead the honest inquirer on and on. The answers to many of these questions will be found in the plant itself: others will need the comparative examination of related plants; some may prove insoluble without help. The lectures organized by the Department are intended to assist the inquirer in these respects. The student can be shown how to look and where to look: but it is essential that he should *see* for himself. In criticizing the papers sent in last January, Mr. Stockdale remarked on the inadequacy of many of the drawings asked for. Some have wondered at the importance the examiner attaches to drawings—especially large drawings "covering half a sheet of examination paper," big in scale and diagrammatic in treatment. The explantion is a simple one. A

drawing is the best record of things *seen* (it need not be a picture in the Royal Academy sense of the word—in fact an artist's picture is usually more or less fanciful) and it is impossible to slur over difficult points in a drawing as can be done in a written description. The lecturer is careful to see that each student has live flowers to examine; he himself dissects specimens and makes sketches on the blackboard. But what happens? The audience copy the sketch—and the whole object of the method is defeated! The students are drawing what the lecturer saw and not what they see themselves. The point is a vital one. The blackboard sketch is a guide only. Unless the student makes the mental effort necessary to record pictorially his own observations he will never have confidence in his own powers of observation nor acquire the ability to examine efficiently the other specimens he meets. It is this confidence that is so badly needed. The process of acquiring it is much like learning to swim. In the old days a strap was put round the learner's waist and suspended to the end of a long pole; the instructor kept the learner up and deluged him with directions as to what to do and how to work his arms and legs. After the regulation "course of 12 lessons" the pupil knew all the strokes—but probably couldn't swim. The method was wrong. Not having had to worry about supporting himself in the water—the strap did that—the learner had no experience of the buoyancy of the water; indeed, supported as he was at the wrong point—his waist—every stroke plunged his chin under and imperilled his breath. Nowadays, the instructor goes into the water with the youngster and, putting one finger under his chin, bids him to strike out for himself. In a marvellously short time the novice feels that the water will support him; he finds his mouth clear of danger and both feet off the ground; unconsciously, as his confidence increases, the pressure of his chin on the instructor's finger grows less and less—and he can swim. It is true he is not an accomplished swimmer: he cannot do the over-arm racing stroke or dive for coins into five fathoms of water: but these things will come in time. In his case the beginning is a good deal more than half the whole. Anyone who has experienced the delicious sensation of a first real swim will understand what we mean. Now it is perfectly easy for any swimmer to tell at a glance whether a beginner is really swimming or has one toe on the ground, and it is quite as easy for an examiner, by the test of a drawing, to discover how far a candidate has gone in the art of learning to observe for himself. The student crammed with facts from a book is of no more use for reliable observation than the "one toe on the ground" swimmer is for water-polo. And original, reliable observations are badly wanted in British Guiana. With the advent of the Economic Biologist and the already recognised

of ordinary planking, 8 ft. high with an 'attap'* roof 15 ft. in the centre. The floor is cemented with concrete below. There are two or three windows which can be opened when required, and one entrance door. The building is on a slope of 1 in 12, and drains run down the side to carry off rain water. Inside are wooden posts sunk in the ground between which run thin rattans, stretched tight, over which the rubber is hung. Near the door are sunk in concrete and cement floors circular pits 1 ft. wide and 3 ft. deep in which the fires are put and then covered with iron cones 22 inches high with a flat perforated top. They have a small oblong opening at the base to admit air to the fire. The fires are made of any dry old light timber, and are allowed to smoulder all day. When the cones are put on no flame is produced but abundance of smoke which soon fills the whole building and keeps a thick atmosphere of smoke all day. As the windows are closed, the smoke can only escape by the spaces between the roof and walls or through cracks, so none is wasted. The house will hold 2,000 lbs. or more of sheet rubber. The newest made rubber is put nearest the fires and moved further up the slope as it dries. The great advantage of the plank walls and 'attap' roof are that the water, creosote and naphtha of the wood smoke are absorbed and do not deposit on the rubber. With a brick house and an iron roof the rubber gets 'messy.' No ventilation other than the cracks is required, but the entrance door is usually kept open. As it is at the lower end, the current of air that enters drives the smoke up to the other end through the rubber. No smoke escapes without having passed over some, at least, of the rubber; the slow smouldering does not raise the temperature; and the fires, being sunk in the concrete and giving no flame, afford no risk of accidents. It is advisable to shift the rubber from time to time in the smoke house, for if not moved a pale line is left where the rubber was in contact with the rattan, and this spoils its appearance.

Germination of Spring and Autumn Rubber Seeds.

It will be remembered that in the first part of their articles on "Rubber Planting in British Guiana" (*Journal*, Vol. IV., No. 2, Oct., 1910), Prof. Harrison and Mr. Stockdale gave tables showing the details of germination of Para rubber seeds obtained at the Georgetown Botanic Gardens. Many of these seeds were got from Singapore, and were of two crops—the spring and autumn. In reprinting these tables in the *Agricultural Bulletin of the Straits and Federated*

* Made from the leaves of the palm *Nipa fruticans*.

Malay States, Mr. H. W. Ridley, F.R.S., the Editor, makes the following comment :—

"The most interesting point, however, in the article, is the difference between the germinative power of the spring and autumn crops. There is a marked difference as will be seen by referring to the table ; the seed of the autumn crop germinates much better. It is possible that this is due to the dryer weather about the time of ripening of the autumn crop. The spring crop comes on early in the year, just after or during the rains. The seeds are only thrown from the capsule during sunshine, and it frequently happens that when they are actually ripe the days are dull and wet and the seeds are retained in the capsule till the first fine day. In this case they have, it appears, a tendency to commence germination in the capsule, and even if the radicle is not protruded the earlier preliminary stages may take place without any external symptoms. Such seeds, when travelling doubtless receive a check in growth which causes their death. Seeds received from various estates in the peninsula have in many cases given extremely unsatisfactory results, few or more in a large lot germinating at all. The cause of this is not clear. It is possibly due to the trees being young and the travelling power of such seeds may be inferior to those of older trees, or it may be due to some effect caused by the heavy *tapping* of the trees. It is, again, possibly *due to imperfect fertilization from the absence or insufficient* supply of flies, which fertilize the flowers. Any way the fact has been very marked."

Co-operation versus Usury.

There is a continual and widespread complaint against the kind of stock-jobbing and exploitation to which our farmers are subjected by the merchants and their agents. Organisations among farmers can, to a great extent, root out this pernicious practice by means of intelligent co-operation among the members preventing the bad but common mistake of borrowing money on their future harvests, and by adopting such measures as will permit them or their agents to place the products on the market or where the prices higher. It is *not* wise to exclaim continually against the abuses of usury and exploitation, when by our indifferent behaviour we are really accomplices and docile instruments of these abuses.

—The Hon. Rafael Palma in "The Philippine Agricultural Review," April, 1910.

Lessons with Plants in British Guiana.

[" *It is finding answers to questions which chiefly deserves to be called Science.*" — L. C. MIALL, F.R.S., in "Teaching and Organization."]

I.

THE HIBISCUS AND ITS RELATIONS.

THE object of this series has been already set forth in the leading article in this number of the *Journal*; following the principle there laid down let us choose some common plant and examine it, and see to what it will lead us.

Of all the flowers of Georgetown, there is probably none more striking than the hibiscus. Its handsome red blossoms are common enough; they adorn dozens of gardens; and the plant is almost always in bloom. The individual flowers, too, are large and easy to examine; which, as we are furnished with only a pair of sharp eyes and a sharp knife is an advantage. As the flower is the most conspicuous part of the plant and is the first to catch our eye, we will begin with it.

EXAMINE THE FLOWER.

Choosing, then, a good specimen, get some idea of its size and shape. If no footrule is handy, use the 'nail joint' of your thumb. In a grown person this is usually about $1\frac{1}{4}$ inches in length. It is best, of course, to measure your own carefully once for all. In general outline the flower is not unlike the filter-funnels you have seen used in the Chemistry lectures, although the lines of the flower are curved and very graceful. Then let us pull it to pieces—dissect it—from the outside. First of all we notice a number of green projecting pieces, fastened closely together on the flower stalk at one end but free at the other. How many are there of them? If you are working in a class, compare numbers. Do you all find the same numbers on all the specimens examined? What shape are these green pieces? Draw them by placing them on paper and running a line round their edges with a pencil. How long are they, roughly? How many times longer than broad? Are they smooth or rough? Scaly or hairy? Are their free ends rounded or do they end in a point? All these questions should be answered in order to describe these little pieces fully.

DRAW ALL YOU SEE.

Now we come to a cup-shaped part of the flower, also made up of green pieces. Count these pieces. Again compare the number you find with those of your class mates, or with the number present in other specimens. Is the number constant? Are the bases of these green pieces free or are they fused together, as it were? About how far down does division extend? Describe the shape and character of these pieces as suggested above. Make a sketch in outline of the whole cup or of, say, three of the pieces. What conspicuous difference, besides in shape, is there between these green pieces and those we just examined? Do you find the green cup contains any liquid? If so, taste it. Is it rain water, do you think? Do you find any insects within the cup? If so, what are they and what do you think they are there for?

Pull away what remains of the green cup, and note the next series of parts. Evidently this forms the bulk of the flower. How would you describe its colour? Draw one of the pieces as before, and note all the points already mentioned. Are they free or joined together? Is there anything you could call a 'stalk'? Pull them away and note how each piece is joined to the dark red stalk-like piece to which we now come. If you repeat this in a fresh specimen you will be able to make out whether the coloured parts arise opposite the parts of the green cup outside them, or whether they 'alternate' with them. A careful examination of the flower will make the meaning of these terms quite clear.

How long do you make this stalk-like piece to be? Note the scars made by breaking off the large coloured members we have just removed. Trace the coloured portion upwards: how far does it extend, and what do you see as you follow it towards the free end? Can you count the number of little stalks which you see? If there are more than twenty, you need not trouble, but may call them "numerous" or "indefinite." What do you find at the top of each little stalk? You will need very keen eyes indeed or the help of a hand-lens to see exactly the details, but a yellow dust contained in tiny kidney-shaped boxes should be obvious enough: and if the parts are 'ripe' the dust will come off on your fingers or may be shaken on to paper. Above this forest of little stalks the red colour ends. What do you notice at the place where it does end? Follow the stalk to the end. How many branches do you note? What are there ends like; are they smooth or hairy, coloured or not; and is there any yellow dust on them?

"fork." If, on the other hand, the terminal bud is not double and is never a flower bud, there is nothing to prevent the branch from continuing to grow straight on until it resembles a fishing rod. If you cannot decide the question from an examination of a hibiscus branch, study the plant, especially specimens which have run wild and have not been clipped by the gardener. Compare these with a mango tree. Does the flower of the mango arise from a terminal bud, and what is the difference in the *habit* of that tree and the hibiscus? What happens when the terminal bud of an hibiscus branch is cut off, as is the case when the gardener trims the bush? Make the experiment yourself and watch the result carefully, drawing sketches —the best kind of notes—of the branch before it is clipped and afterwards at different stages of its growth.

COMPARISONS.

Having now made a start with one flower, and gained certain information at first hand about it, the student will be interested in examining related plants. Investigate the flowers of the ochroe, the sorrel, the "jumbi ochroe"; take a walk along the Sea Wall to Kitty and look at the trees growing by the shore. You will probably find a couple in flower, which will strike you as familiar. Examine them in the same way as you did the hibiscus and compare results. In all the plants y.u do, it is important to notice the time at which the flower opens and when it closes. The sorrel and "jumbi ochroe" you will find especially noticeable in this respeet.

You should have enough now (if you work thoroughly and draw fully) to occupy a good deal of your spare time until the next number of the *Journal* appears; when we shall proceed to consider other points.

(*To be continued.*)

A Mule Query—and Reply.

Which is the better mule? From a stallion and a donkey mare, or from a jack and a mare? I am informed that by breeding from donkey mares a much larger mule is procured. Is that so?—T. L. Minster, Wakkerstroom.

By far the more valuable hybrid is that from the jack donkey and mare horse; it is much larger than the one from a stallion horse and donkey mare.—J. M. Christy, Assistant Principal Veterinary Surgeon.

—Agricultural Journal of the Union of S. Africa, Feb., 1911.

Book-keeping for Small Farmers.

If Agricultural Loan Banks are established in this colony, the small farmer who hopes to profit by the accommodation they offer will be well advised to keep some kind of books. A careful record of income and expenditure must weigh heavily in favour of an applicant for a loan and it is hoped that the following hints, which are founded on a pamphlet issued by the Board of Agriculture and Fisheries of England, may prove useful. The great point is to keep the clerical work within reasonable bounds. Where the farmer works on his own holding with, perhaps the assistance of a few labourers, it is essential to use a very simple system requiring the minimum of books and places of entry.

DIARY.

The diary is intended to contain *daily notes* of cultivations, manures applied, crops sown and harvested, food consumed and any observations the farmer may think worthy of record. Columns should be provided for daily receipts and payments, and also a form for labour account. The whole of the entries for the day, however varied in character they may be, are made in this book. The following is an example of the form, but the space allotted to each day's entries would, of course, be much greater.

DIARY.

Date.			Received.	Paid.
		Brought forward		
	Monday	[In this space a record should be made of all farm work, purchases, sales, orders, etc.]		
	Tuesday			
	Wednesday, etc.			
		Carried forward		

WEEKLY LABOUR ACCOUNT.

Name of Labourer.	M.	Tu.	W.	Th.	F.	S.	Total.	Rate of Wages.	Paid.
Carried forward									

CASH ANALYSIS BOOK.

This is a book to which receipts and payments are transferred from the Diary and entered in columns to their proper accounts. Any number of columns may be provided; one should be allowed to each class of stock, produce, or other items of which it is desired to keep a separate record. For convenience the totals should be made up monthly and transferred to a summary page.

CASH ANALYSIS BOOK—Receipts Page.

DATE.	From whom received and particulars.	Plantains.	Sugar-Canes.	Corn.	Poultry.	Cattle.	Sundries.	Value of Produce used by household.
	Total at end of year.							
	Add money owing but not received.							
	Deduct money owing but not received at beginning of year.							
	Total Sales for the year.							

CASH ANALYSIS BOOK—Payments Page.

Date.	To whom paid & particulars.	Suckers.	Seeds.	Cane-tops.	Manures.	Rent, taxes, etc.	Labour.	Sundries.	Household expenses.
	Total at end of year.								
	Add money owing but not paid.								
	Deduct money owing but not paid at beginning of year.								
	Total Payments and Expenses for the year.								

PROFIT AND LOSS ACCOUNT.

The profit and loss account is prepared at the end of the year, after a valuation of stock, as follows:—

PROFIT AND LOSS ACCOUNT.

To valuation of live and dead Stock, tillages and unexhausted improvements at beginning of year.			By Sales & Receipts from Analysis Book, viz :—	
			Plantains	
			Sugar-Cane	
To Payments and Expenses from Analysis Book viz :—			Poultry..	
			Cattle	
Suckers			Sundries...	
Seeds				
Cane tops..........			By valuation of live and dead Stock, tillages and unexhausted improvements at end of year.	
Manures............				
Rent....			Farm produce used by household.	
Taxes, etc.				
Labour..............				
Sundries				
To Balance—profit for the year.				

Household expenses are not entered in the Profit and Loss Account, since they have no bearing on the profitableness of the business. The value of farm produce consumed on the holding should be entered in the Receipts Book in the same way as if it were actually sold.

The foregoing system of accounts has the advantage of being easily understood and little liable to errors. It presents in a concise form the material from which a very close estimate may be made of the state of affairs on a small farm. It may be recommended to those farmers who have not previously kept accounts or who have a disinclination for books. The Royal Agricultural Society of England publishes ruled account books for such a system; and it might be worth while for the Loan Societies already in existence or the Loan Banks projected to import such books and insist on each applicant for a monetary advance buying one and keeping it properly.

Coconuts and Coconut Planting.

RUBBER has compelled so much attention from tropical agriculturists of recent years and has proved so remunerative and alluring that the value of the older and less fashionable cultivations has become somewhat obscured. As rubber settles down, however, and finds its proper place in the planter's scheme of things, the long-headed ones who in the choice of a cultivation have preferred the sound to the the sensational will find their wisdom abundantly justified. And for soundness there are few things tropical which can compare with coconuts.

ORIGIN AND USES.

Whether the coconut (*Cocos nucifera*) is a native of the east or of the west is still an open question. A. de Candolle, after a preliminary leaning towards the latter view, swung round to the former. The matter is, we believe, still undecided, and though deeply interesting is purely academic. Wherever the palm had its origin, the east has undoubtedly made the more use of it. " The leaves serve for roofing, for mats, for baskets, torches, fuel, brooms, fodder for cattle and manure ; the mid-rib of the leaves for fences, for shoulder-yokes (for carrying baskets, etc.), for fishing rods and many domestic purposes ; the cabbage or cluster of unexpanded leaves for pickles and preserves; the sap for toddy, for distilling arrack and for making vinegar and sugar ; the unformed nuts for medicine and sweetmeats ; the young nuts and their milk for drinking and for desert ; the green husk for preserves ; the ripe nuts for eating, for curry, for milk for cooking; the oil for rheumatism, for anointing the hair, for soap, for candles, for light ; the *poonac* or refuse of the nut after expressing the oil, for cattle, poultry and even human food ; the shell of the nut for drinking cups, charcoal, tooth-powder, spoons, medicine, hookahs, beads and bottles and knife-handles ; the coir or fibre which envelops the shell within the outer husk, for mattresses, cushions, ropes, cables, cordage, canvass, fishing nets, fuel, brushes, oakum, hammocks and floor mats ; the trunk for rafters, laths, sailing boats, troughs, furniture and firewood ; and when very young, the first shoots or cabbage, as a vegetable for the table." * It is small wonder that any native with twelve coconut trees and two Jaks in bearing claims to be independent. On the commercial scale the chief products of this valuable tree are the nuts, copra (or the dried meat of the nut), coconut oil, expressed from the copra, and coir fibre. The

* Tennent's " Ceylon."

oil is largely used for soap-making, the coir fibre for brushes. There are 24 coconut fibre factories in the United Kingdom alone, and the demand for the raw material for soap-making is steadily increasing. It was the rise in price of this raw material that led to the recently attempted "combine" among the chief soap-boilers of England, with its sensational sequel in the shape of libel suits against certain prominent newspapers. It has been neatly and truly remarked that the advance of civilization may be judged from the increase in the use of soap; so the coconut planter has justification for his confidence in the future. His only serious competitors are mineral petroleum (kerosene) and the African oil palm (*Elaeis guineensis*).

PRODUCTS AND PRICES.

Carefully planted and cultivated coconut palms, under favourable conditions in British Guiana, should yield average crops of from 80 to 100 nuts per tree per annum, and the life of the plant in favourable conditions of soil and cultivation may be reckoned at from 80 to 100 years. Present prices for nuts rule locally at $10 to $16 per thousand. In Ceylon nuts have fetched £3 to £4 per 1,000, a very profitable rate being £3 3s. In the estimate given by Mr. H. N. Ridley, F.R.S., Director of the Botanic Gardens, Singapore (quoted in this *Journal*, Vol. III. No. I., July, 1909), nuts are priced at £2 6s. 8d. per 1,000 and the crop per tree is reckoned at 50, there being 60 trees per acre. Ceylon coconut oil in London has varied from £38 per ton in 1877 to £25 in July, 1903. Copra, during the boom in May and June 1902, rose to £33 10s. per ton, now it is quoted at £24 10s. It requires about 40 full-grown nuts from an average good tree to make 1 gallon of oil, 12½ of which (about 500 nuts) to go a cwt. worth perhaps $5. Copra works out at about 170 to 200 nuts to the cwt. In Jaffna, 1,000 full grown nuts will give 525 lbs. dried copra, capable of yielding 25 gallons (or 2 cwt.) of oil. In taking over land for public purposes in Ceylon, each coconut palm is valued at Rs. 10 (R1=one B. G. 'guilder.')* The export of nuts and copra seems to be on the upgrade in British Guiana; 200,000 coconuts having been recorded in the Customs returns in 1908, 636,000 in 1909, and 994,000 in 1910; while the figures for copra during these years were 186 cwt., 467 cwt. and 306 cwt., respectively. From latest advices the area under coconuts is 9,760 acres. So far coconut oil does not figure in the returns, although there is promise of it. In 1902, Ceylon exported 12,588,212 coconuts, 512,498 cwt. of coconut oil, 374,796 cwt. of copra, 144,889 cwt. of desiccated coconut and 247,696 cwt. of *poonac* besides a huge

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* For these and other facts concerning the Ceylon coconut industry we are indebted to the publications of the "Ceylon Observer" Office.

amount of coir as rope, yarn and fibre; the whole to the value of nearly Rs. 19,000,000 (about $6,000,000). In Ceylon natives own 525,000 acres out of the total of 650,000 under coconuts. There seems to be a lesson here for British Guiana.

CLIMATE AND SOIL.

The coconut palm needs a warm, moist climate, with an average temperature of 80° Fahrenheit and a rainfall of at least 70 inches per annum. It thrives well in alluvial flats along the banks of large streams provided flooding is not frequent or too prolonged. A deep loamy sand is always suitable for the tree, but heavy clays or peat soils are to be avoided. Good drainage is essential, for stagnant water is, as always, disastrous to cultivation. Hence, too, there is danger in planting in good land overlying a stiff and impermeable sub-soil. Light, sandy soils are excellent carriers of manure, and providing cultivation is assiduous and intelligent and the water supply doesnot fail, coconuts will do handsomely in them. There is not much choice in British Guiana, at least so far as the coastal lands are concerned; but the preference shown by planters for the lighter soil in the neighbourhood of Mahaicony and Belladrum is fully justified. The coconut palm is popularly credited with a liking for sea air and salt water. Certainly *Cocos nucifera* is a real 'halophyte'; that is to say it can tolerate an amount of salt in the soil water which would kill another plant, but it does not appear, from all the evidence available, that salt is indispensable to its welfare or thrifty growth. Salt is sometimes given as an artificial manure in coconut cultivation. In Brazil as much as a bushel per tree has been applied when salt was at 2s. per bushel; but it is probable that the money was wasted. Any beneficial action that may be observed is more likely to be due to the secondary action of the salt on the zeolites of the soil than to its direct action on the plant. Coconuts do perfectly well far from the sea and at considerable elevation. There is a plantation in bearing at Badulla, in Ceylon, 100 miles inland and nearly 2,000 feet above sea level, and a record of a healthy but barren palm at an elevation of 4,000 feet in India.

SALIENT POINTS.

Too much care cannot be bestowed up on the selection of suitable nuts for seed. This is a point which this Department is constantly dwelling upon; not for coconuts only, but for rice, cacao and all economics that are propagated 'sexually.' In Ceylon so much importance is attached to this matter, that many planters insist on choosing all seed nuts themselves and delegate the duty to nobody.

Nuts which are quite ripe should be chosen from palms in full vigour—neither too young nor too old—which bear good crops of nuts having thin husks and thick kernels. The nuts should be picked. It allowed to fall, the polished exterior of the fruit is liable to be cracked or wounded, affording lodgment for moisture and the germs of disease and decay. If fallen nuts are chosen, they must be carefully selected —it is essential that they be uninjured . This is not always to be ascertained from an external examination, and the 'shell' surrounding the kernel is liable to be fractured by the fall. Picked nuts gathered just as they are about to fall are more reliable in every way. Nuts gathered from immature trees are apt to give rise to precocious plants, which, after an abnormally abundant fructification, die away. Dry nuts, on the other hand, germinate slowly and produce feeble shoots. It is advisable to keep the nuts for a month before planting them out, especially if they have been gathered before they are quite ripe, to give the epidermis an opportunity of hardening and to allow of any grave defect developing and being detected. This delay is in no way harmful : Coconuts 'keep' splendidly and retain their germinating power undiminished for many weeks. To this property the plant owes its wide distribution in nature.

A GOOD START ESSENTIAL.

The larger nuts on the bunches should be selected for planting, but very large nuts are not always the best, for only a few may be borne on the tree and their exceptional size may be due to excessive development of the husk at the expense of the kernel. A case is quoted by W. B. Lamont of two trees next each other in a line : one bore very large nuts, but its annual crop never reached 30, while its neighbour with very small fruit yielded 300 nuts per annum and the weight of the copra was four times that of its big-nut companion. Finally, oblong nuts should be avoided. The large orange-red variety is the best for planting, both from the point of view of size of nut and yield of copra. But as the yield of a coconut tree depends almost entirely on its getting a good start in life and after being planted out, we própose giving in a later article instructions as to its planting out and cultivation. Nothing is more fatal to the hopes of the cultivator of coconuts than the tree being stunted in its early stages. It cannot recover from this and its future yields are permanently affected.

Visit of the Dutch Royal Commissioners.

A VERY pleasant episode at the end of June was a visit from the Royal Commissioners, Dr. Bos, Heer van Vollenhoven and Dr. de Monchy (Secretary), sent out by the Dutch Government to investigate the condition of Surinam. On their way home *via* New York the Commissioners took the opportunity to visit British Guiana. Accompanied by Dr. Cramer, Director of Agriculture in Surinam, they landed at Springlands, Courantyne, where they were met by Prof. Harrison (Director of Science and Agriculture) and the Science Lecturer, and proceeded in motor cars to New Amsterdam after refreshing themselves, after a rather difficult landing, at the Manager's house, Springlands. On the way up the coast they called at Pln. Albion, where Mr. Cecil Morris showed them the factory, and the pumping station and expounded the art of sugar-making in British Guiana in a way that delighted his visitors. They were much interested, too, in the condition of the Courantyne district and in the rice cultivation ; Heer von Vollenhoven, who is a planter of great experience in Sumatra, being especially emphatic in his assertion that rice and coconuts are the backbone of the prosperous peasant in the tropics. Lying at Colony House, Berbice, for the night, the party proceeded next day to Georgetown by train, Heer von Vollenhoven and the Science Lecturer only travelling by motor car so that the Commissioner might have a closer view of the coconut plantations on the way.

AT ONDERNEEMING.

While the Commissioners were in Georgetown, Prof. Harrison arranged a trip to Suddie and Onderneeming, A very pleasant outing enabled the visitors to get a good idea of the Industrial School, where the buildings were inspected and a fire-drill witnessed. The Commissioners were much impressed at all they saw and complimented Mr. S. H. Bayley on his excellent work. Dr. Bos, who is an international authority on education and was mainly responsible for the recent re-organization of the system of instruc tion in Holland, also took the opportunity of discussing that interesting subject with the Director and the Science Lecturer, and expressed his warm approval of the methods adopted by the Department of Science and Agriculture. On leaving for New York and Holland, *via* Curaçao, the Commissioners announced themselves delighted with their visit and the hospitality shown them and

declared that they had seen much in British Guiana to help them in their deliberations regarding the future of Surinam. Dr. Cramer remained some days longer in the colony, and paid a longer visit to Onderneeming whereby he was able to study the cultivation there. It is probable that he will revisit British Guiana later in the year.

Model Gardens in British Guiana.

Everything feasible is done to make the work in the gardens as attractive as possible to the children attending them, every opportunity is seized upon to arouse and sustain the interest of the children; and I am in a position to state that the object of these gardens has been attained to a marked degree. No longer is there any objection on the part of parent or pupil to taking active part in the practical work, and the heartiness with which most of the pupils engage in the work augurs well for the success of the scheme. It is evident that the elementary principles of agriculture are being firmly laid, and a taste for the subject acquired which must eventually lead to beneficial results in the rearing of a class of agriculturists with views far in advance of those obtaining at the present time among the majority of farmers in the colony.

The moral effect of the Model Gardens in the communities in which they are established is also marked. Kitchen gardens have sprung up where before none existed and the methods of culture followed in the Model Gardens is very closely copied by the villagers.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

Copra in 1910.

Copra, as the most important item of produce in the coconut industry, must be regarded as having had a very profitable year considering the record prices which were realised. Coconut oil also found a very ready market the world over, and prices showed a steady upward tendency. An important point to be considered while on the subject of coconut oil is the predicted scarcity of cotton, which would necessarily bring with it a shortage of cotton-seed and cotton-seed oil. Coconut oil is in some respects a competitor of cotton-seed oil in the various uses to which it is put, and it is quite within reason, in the event of an increase in the cost of the latter, to anticipate a largely increased demand for the former.

—Agric. Bull,. S. & F. M. S., Feb., 1911.

Results of Experimental Rice Milling.

OUR readers who are interested in the cultivation of rice will doubtless recollect that the Department of Science and Agriculture sent samples of the rices produced in 1910 to the rice mills belonging to Messrs. Wieting & Richter, which fi m, as they have don: in fo-mer years, very kindly offered to mill them. Appended are extracts from Messrs. Wieting & Richter's report :—

No. 75 : " It was very easily milled and would make a first-rate rice of either quality."

No. 6 : " Of a very good quality for both brown and white, and is quite easily milled."

No. 3 : " Very good for white rice, but not so easily handled for brown, and the colour is very poor."

No. 4 : " No good for brown rice and gives a very poor white, the grain being very small and very hard to mi'l."

Carolina Golden Grain : " No good for brown rice as it is has a reddish colour, but will make a fairly good table white rice. It is very hard to mill."

Creole : " The paddy is poor in quality and gave a very bad brown rice in colour and a bad return in white."

From the above report it will be seen that Nos. 75 and 6 are the best for brown rice, while the barley grain (Carolina Golden Grain) is not suitable.

The following table puts the facts in another way :—

NAME.	YIELDS OF RICE PER CENT. OF PADDY.	
	White Rice.	*Brown Rice.*
No. 75	60	55.7
No. 6	80	46.8
No. 4	80	61.9
No. 3	72.5	45.8
Carolina Golden Grain (Barley rice)	60	67.5
Creole	72.5	42.7

It is satisfactory to find that previous reports on Nos. 75 and 6 are so fully corroborated. The cultivation of Nos. 4 and 3 and the first strain of Carolina Golden Grain will be given up at the Experimental Fields and every effort will be made to get as large quantities as possible of Nos. 75 and 6 for distribution.

School Children and Tuberculosis.

SUGGESTIONS FOR A LECTURE.

THE following is only a sketch on which to elaborate a talk which should not consume over twenty minutes or a half hour. There should be much coming back to important points with repetition to drive home the fundamentals. The wording should be simple and all technical terms should be avoided :—

INTRODUCTION.

Consumption is a disease that affects the lungs with which we breathe.

Consumption makes many people sick, and a great many of them die from it if they are not well taken care of.

Consumption is caught from other people who have the disease.

Consumption can be prevented by doing certain things and not *doing other things.*

THINGS TO DO.

(*a.*) Get lots of fresh air all the time. All the time means night as well as day. It is more important to have fresh air at night than at any other time. Learn to sleep with all the windows open and outside on the verandah, if possible. If one ever finds how nice it is to sleep outdoor, they will never want to sleep in the house again. The night air is not harmful, it is healthy. Now-a-days lots of people sleep outdoors, because it is so much nicer than to sleep in a room. If you do have to sleep in a room, have all the windows and doors open.

(*b.*) Keep your body clean. Every person should take a cold bath every day. You don't need a bath tub to do this. With a pail of water and a cloth you can have a refreshing bath all over. One should not only take an all-over bath every day, but one should always wash the hands before eating. It is easy to forget this, but it is a fact that the healthiest people are those who take care to have clean hands when they eat.

(*c.*) Sleep alone. We know that one person takes consumption from another person who already has the disease. When persons sleep together, it makes them apt to take any disease the other ones have.

THINGS NOT TO DO.

(*a.*) The greatest way for consumption to get to one is by the spit from the person who has the disease. So you must learn to do without spitting unless you can spit into something where it will be washed away or burned. If you all grow up with the habit of not spitting unless the spit is to be destroyed, it will stop the spread of consumption tremendously. Don't spit yourself, and tell others not to do so.

(*b.*) Don't put in your mouth anything that has come from the mouth of another person. This means apple cores, chewing-gum, whistles, candy, etc.

(*c.*) Don't kiss a sick person. This is a foolish thing to do, and don't let people who are sick kiss you.

(*d.*) If you get thin or have night sweats, see a doctor. If you have a cough that lasts over ten days see a doctor.

THE PREVENTION ALPHABET.

A is for Anybody who can help to prevent Consumption, a child just as well as a grown up person.

B is for Breathing, which you should learn to do deeply. Take deep breaths in fresh air often.

C is for Coughing, which you should never do in anyone's face nor should you sneeze in anyone's face.

D is for Don't. Don't swap apple cores, candy, chewing-gum, half eaten food, whistles, or anything you put in your mouth.

E is for Eating no fruit that has not been washed or peeled, or anything that is not clean.

F is for Fingers, which should not be put in the mouth nor wet to turn the pages of books.

G is for Giving good example to your fellow pupils and playmates by being always neat and clean, just as much at home as at school.

I is for Illness of other kinds besides consumption, which following these rules will help to prevent, such as colds, measles, grippe, diphtheria and pneumonia.

J is for Joints, where children have tuberculosis more often than in their lungs.

K is for Keeping your finger-nails clean. A scratch from a finger-nail may make a bad sore.

L is for Learning to love fresh air, and not learning to smoke.

M is for Mouth, which is meant to put food and drink into, and not for pins, or money, or anything not good to eat.

N is for Nose, which you should never pick nor wipe on your sleeve.

O is for Outdoors, where you should stay just as much as you can. Always play outdoors unless the weather is too stormy.

P is for Pencils, which you should not wet in your mouth to make them write blacker.

Q is for Question, which you should ask your teacher, if you don't understand these rules.

R is for Roughness in play by which you may hurt yourself or your comrades. If you cut yourself, have been hurt by others or feel sick, don't fear to tell your teacher.

S is for Spitting, which should never be done except in a spittoon, or a piece of paper, or a handkerchief used for that purpose alone. Never spit on a slate, on the floor, the play-ground, nor on the sidewalk.

T is for Teeth, which you should clean with a toothbrush and water after each meal, or when you first get up in the morning and before you go to bed at night.

U is for Unkind, which you should never be to a Consumptive.

V is for Vessels, like drinking cups and glasses, which should not be used by one child after another without being washed in clean water each time.

W is for Washing your hands with soap and water before each meal, even if it is only lunch.

X is for X-rays, which sometimes help us to discover consumption or other forms of tuberculosis.

Y is for You, who should never kiss anybody on the mouth, nor allow them to do so to you.

Z is for Zeal in carrying out these rules.

—Dr. W. C. Hobdy in "The Hawaiian Forest," Dec. 12, 1910.

Areas under Subsidiary Products.

From the latest census returns, we have been able to compile the table given below, which shows the areas under subsidiary products in British Guiana in 1910:

Rice	31,680	acres.
Provisions	18,600	„
Coconuts	9,760	„
Coffee	2,540	„
Cacao	2,010	„
Rubber	1,740	„
Limes	.560	„

Contour Drains and Surface Soil.

The attention paid to the preservation of the surface soil is therefore confined to the making of surface drains, called in Java "Vanggoten." Sometimes these drains are cut in semi-circles, forming canals round each tree. In my opinion, however, a better method was one employed on an estate in Perak. The drains were laid at right angles to the direction of the slope in such a way that they were always in the same horizontal level. The vertical distance between them was always 25 feet, so that o 'he steeper slopes the drains, measured along the surface, would lie much nearer to each other than on the flat. The expenditure on these "Contour Drains" would work out at about $10 an acre; and the annual maintenance was increased about $1 an acre. Everything possible should be done to keep the surface soil together. The amount of earth lost from erosion is larger than might be thought; it would cost some hundreds of dollars per acre simply to replace by manure the mineral matter washed away every year with the surface soil. On the highland coffee plantations of Java this experience has been dearly paid for in the early years of the industry. Although coffee is different from Hevea, it is still necessary with the latter to avoid from the beginning the loss of the most valuable part of the estate—the surface soil.

—Dr. P. J. S. Cramer (Director of Agriculture, Surinam), in "Proc. Agric. Soc., Trinidad and Tobago," Jan., 1911.

Review.

THE RUBBER COUNTRY OF THE AMAZON.

By Henry C. Pearson.
(Editor of " The Indian Rubber World. ")

When an American man evolves a book he is pretty sure to make it readable. He has no compunction in utilizing the finer flowers of the American language or even the Roosevelt spelling, if he feels he needs them to ornament his pages. He can usually see the humorous side of a situation and can bring it home to his readers too. The result, as Mr. Pearson remarks of the journey to Manaos, is " sure to be interesting anyhow. " When the author happens to be an authority on his subject—as in the case under review—and combines a wide theoretical knowledge with much practical experience, the pill of instruction is administered under the sugar-coating of amusement, and the readers derives information while being thoroughly entertained.

It was a happy thought that sent Mr. Pearson up the Amazon. " Fine hard Para " is still something of a mystery, and much light yet needs to be thrown upon its precise composition and preparation. Readers of the book will be best able to judge how far Mr. Pearson has succeeded in his efforts in this direction. Then the mammoth size of the great river, the darkness which broods over the vast unexplored forest region beyond its banks, the legends of disease and death which haunt its turbid flood, and, above all, the glamour of Manaos, the city set a thousand miles from the sea, yet with *direct* ocean sailings to the United States and Europe, and sending her steamers yet another thousand miles inland to Iquitos ; Manaos which bids fair to become an El Dorado more dazzling than ever Spanish imagination pictured in the ancient days ; all these things are of peculiar fascination and, being fully treated by our author, add to the charm of his book.

Mr. Pearson, in short, has managed to combine most effectively the practical with the picturesque, the utilitarian with the literary ; and while treating present-day problems he does not neglect prophecy. Compare his remarks on the mosquito :—" Another thing, every window and door in my house (in Manaos) should have screens, even if none other in the city followed suit. The yellow fever mosquito is a city dweller, and if he was driven out of Panama by screening

and a little sanitation, he can be out of Manaos. The Government is alive to it, but the people, foreigners and all, seem indifferent "—with his predictions inspired by the Madeira-Mamore railroad:—"*The day will come when Manaos will be connected with the Guianas, certainly by wireless and almost as certainly by railroad.*

. . . . The Madeira-Mamore railroad is the precursor of a great number of roads that will undoubtedly be projected to open up the vast country of the Amazon valley". . . . . "Some in Manaos have the ambition, which may not be as wild as it seems at first, to negotiate a short cut to the United States by way of British Guiana. All they would have to do would be to go up the Rio Branco, cross to the Essequibo, and come out at Georgetown, Demerara." In such a manner did Cecil Rhodes formulate the Cape to Cairo line, which is now well on its way to accomplishment.

But we will not spoil Mr. Pearson's public by extracts. Indeed, this is a work which must be read as a whole; and we trust it will not be long before we shall have the pleasure of welcoming a book by the same facile pen on "The Rubber Country of the Guianas."

The Final Italics are Ours.

The caterpillar pest (*Brassolis sophoræ*) of coconuts was common in Georgetown and around Mahaicony during the early part of the year. The coconut estates at Mahaicony were visited, and a brief report indicating the situation there and embodying the details of the life history of the pest worked out by Mr. Bartlett in 1905, was published and widely distributed. This pest can readily be kept in check by destroying the "nests" in which the larvæ rest during the day, *provided the work is thoroughly and systematically carried out.*

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

Ceylon's Biggest Heveas.

We learn on enquiry of the Superintendent, Heneratgoda Garden (Ceylon), that the three largest Para rubber trees there, at three feet from the ground, are in circumference 10 feet 4½ inches, 9 feet 5½ inches, and 9 feet 3 inches, while at the Culloden estate, Kalutara, the measurement of a 27 years' old "Hevea Brasiliensis" is, at 3 feet, 198¼ inches round the stem. There is another tree of 20 years, 121 inches in girth.

—Supplement to "Tropical Agriculturist" (Ceylon), March, 1911.

Fighting the Cane Rat.

RATS are always a nuisance, and sometimes a grave menace, in a cane-piece; and some useful information regarding effective methods of fighting the rodents is contained in a letter addressed to the *Australian Sugar Journal* by Mr. C. E. Jodrell. Informing in itself, it is doubly interesting as demonstrating how an intelligent farmer can conduct experiments on his own account, and solve local problems for himself. We take the liberty of quoting freely, as it is only fair to the author to give his method in his own words. The practical immunity of rats to arsenic seems new.

"When I first leased my cane farm, some seventeen years ago, it was one of the most rat-infested holdings on the Goondi Estate especially that portion of it bordering the Johnstone River. So overrun was this particular portion with the vermin that, out of two successive cane crops harvested therefrom, it would have been well nigh impossible to discover a single stalk of cane untouched. It became very evident to me that unless I waged a successful war against the pest, I would not find cane-growing profitable. Consequently I commenced poisoning, using various methods, and in the end I was successful. My farm is now practically free of the pest and has been so for many years, but the process of finding out the most effective way of exterminating the rats, though now apparently simple enough, was a long and tedious one, involving a good deal of time and expense. This, however, can, I feel sure, be obviated to a very considerable extent by those who desire to profit by my experience.

ARSENIC FAILS.

"In the first place, I was recommended by the chemist then in charge of the Goondi Mill to use rice boiled and mixed with arsenic. This I found, owing to our moist climate, went mouldy very quickly. In any case it proved a failure, as the rats refused to touch it.

"Some time afterwards, Mr. Tryon, when visiting the district, advised me to try corn soaked in water mixed with a solution of strychnine. The rats did not take to the corn so treated, and this method of poisoning them also proved quite unsuccessful.

"Later on Dr. Maxwell, during his first visit to the Johnstone, advised me to make baits of oatmeal and molasses, mixed with arsenic, and place them near the rat-eaten cane. The rats did not

take kindly to these baits, and, though a few of them were eaten or partially so, no dead rats were found, nor was any diminution of cane destruction noticeable.

RATS FED ON ARSENIC.

"Then I tried small pieces of meat and cut bananas, into each of which I put a dose of arsenic. Although many of these baits were taken, the results did not appear to be fatal to the rats, and the destruction of the cane went on as rapidly as ever. To satisfy my curiosity, I trapped two rats alive, and fed them on arsenic baits. They sickened a good deal at first, but eventually recovered and no further feeding on arsenic baits appeared to make any impression on them. Such was not only my experience, but also that of my neighbour, Mr. Molle, who was at the time conducting similar experiments. I therefore have no confidence whatever in arsenic as a poison for our cane rats.

SUCCESS AT LAST.

"As a result of repeated trials and experiments for the destruction of rats, I find the most effective poison—in fact, the only effective poison for the purpose—is strychnine ; and the food chosen to mix it with should be that which the rats have hitherto been living on. For instance, where patches of bananas or even only odd banana plants exist, it will invariably be found that the rats in the vicinity will readily eat bananas poisoned with strychnine, and they will under similar conditions take baits made out of sweet potatoes or of cane.

CHOOSE YOUR TIME.

"It is practically useless to poison rats (especially with cane baits) when they are revelling in acres of sweet cane. The time to poison with advantage, is immediately after each canefield is cut and burnt off, when poisoned cane will be found most effective. A farmer can always procure a stalk or two of cane elsewhere for the purpose or reserve a stool of his own cane. In the case of a crop of young plant cane, a few baits should be distributed as a precaution before actual signs of the pest are seen. Generally speaking, the period for poisoning is from Christmas to, say, April or May.

"The utmost vigilance is necessary to detect the first signs of destruction, which, when observed, should without loss of time be met by a plentiful distribution of baits.

HOW TO PREPARE THE POISON.

"I have found the most effective way of applying the strychnine as follows :—This poison as sold is too large in the grain, and should be ground as fine as possible. For this purpose an earthenware jar and a round-headed bolt will be found suitable. After grinding, place the poison in a small tin, the lid of which should be perforated with very small holes, all of which must be made within a circle of about the size of a shilling. This will prevent the powdered strychnine from spreading too much when shaking out. The bananas used for poisoning should be neither too ripe nor too green, and in a similar condition to those used for ordinary consumption. If the banana is of medium size, cut it in two ; if large, cut it into three sections.

"Then cut each section lengthways, without cutting the back skin, lay a number of the split sections, with their backs on, say, a newspaper, and shake the strychnine tin over each one. Then close the sections carefully together, and place them in a billycan ready for distribution.

"I generally make up from 50 to 100 of these baits at a time.

CANE-BAITS.

"In the case of cane being used for baits, take a piece of cane 4 or 5 in. in length, split it down lengthways into either two or three sections, according to its size, and pepper the strychnine over the inside of each section, then close and press the sections into their original positions, and so place them carefully in the can ready for putting out in the canefield. Sweet potatoes can be used for baits in much the same way. The composition of either the banana, sweet potato, or sugar-cane is such as will readily absorb the strychnine, and this will be assisted by pressing the sections together as advised.

ANISEED ESSENTIAL.

"It is absolutely essential, before preparing the baits, that a drop of essence of aniseed should be put on the hands of the person making up the baits, and another drop should be again used similarly just before distributing them. The aniseed not only does away with the smell of the hand from the bait, but has a strong attractive smell for the rats.

"I may here state that, a few days after distributing for the first time bananas poisoned with strychnine in the cane-field bordering the Johnstone River previously referred to, I revisited the field and the smell of the dead rats was very pronounced; but to me it was a most welcome smell.

"When the cane baits are placed out in the field, the sections should be separated, and each one laid on its back, so that the rats can more easily gnaw them.

THE NEED FOR CO-OPERATION.

"If the pest is to be properly stamped out, concerted action on the part of the owners of rat-infested farms is very necessary. It is certainly not encouraging for any one farmer to poison rats on his farm if his neighbours continue to breed him a fresh supply.

THE COST.

"No cane-grower can object on the score of expense to poisoning on the lines here laid down. All that is required is a 1oz. bottle of strychnine, costing, say, 5s., and one of aniseed, 1s. Both should last quite a whole season, even on a badly rat-infested farm. The food forming the baits costs really nothing, and can be made always available. There is also the time taken in preparing and distributing the baits, which would amount to about two hours, say, twice a week for a few weeks for the year—a cheap process surely, and one which, if carried out systematically by each grower, will, I feel confident, speedily lead to the extermination of the pest.

"I omitted to mention earlier that some three years ago the Commissioner of Public Health, Dr. Ham, through his inspector, Mr. Dudly, inaugurated in this district a series of experiments for poisoning rats with a rat-virus and with a phosphorus paste. Generally speaking, the results were not successful. I will shortly recapitulate the chief essential measures to be adopted for the destruction of the rat pest by strychnine poison :—

(*a.*) *Use for poisoning the food the rats are used to.*

(*b.*) *Poison at the time of the year when the cane is not ripe.*

(*c.*) *Concerted action on the part of the growers.*

(*d.*) *Never forget to used the aniseed.*

C. E. JODRELL.

Laticiferous Trees of the Amazon Basin.

PUBLISHED as an appendix to Mr. Henry C. Pearson's valuable book "The Rubber Country of the Amazon" is a list of the latex-producing trees in the Amazon Basin. As this will be of considerable interest to those concerned with rubber, balata and similar industries in this colony it is here given in full. It will be noted that although the number of latex-producing trees is considerable, that of those known to yield true rubber on the commercial scale is very limited.

SPECIES OF HEVEA.

Name.	Botanist.	Name.	Botanist.
Hevea guyanensis	Aublet	*H. randiana*	Huber
H. nigra	Ule	*H. brasiliensis*	Muel. Arg.
H. lutea	Muel. Arg.	*H. spruceana*	Muel. Arg.
H. cuneata	Huber.	*H. similis*	Hemsley.
H. apiculata	Muel. Arg.	*H. discolor*	Muel. Arg.
H. benthamiana	Muel. Arg.	*H. pauciflora*	Muel. Arg.
H. Duckei	Huber.	*H. confusa*	Hemsley.
H. paludosa	Ule.	*H. nitida*	Muel. Arg.
H. rigidifolia	Muel. Arg.	*H. viridis*	Huber.
H. minor	Hemsley.	*H. kunthiana*	Huber.
H. microphylla	Ule.		

SPECIES OF CASTILLOA.

Castilloa Ulei.	Warburg.

SPECIES OF SAPIUM.

Sapium Marmieri	Huber.
S. aereum	Muel. Arg.
S. pavonianum	Huber.
S. Poeppigii	Hemsley.
S. stenophyllum	Huber.
S. tapuru	Ule.
S. lanceolatum	Muel. Arg.

SPECIES OF BALATA.

Mimusops densiflora	Huber.
M. amazonica	Huber.
M. elata	Freire.
M. paraensis	Freire.
M. discolor	Freire.

Hints, Scientific and Practical.

Botany in Education. BOTANY will not attract the attention of the high-school boy unless 't meets every-day conditions, unless it puts him in touch with his every-day environment in a way that is *sympathetic* as well as *illum:nating*. Moreover, it is perhaps of equal mportance to bring the public to understand what a fundamental place the knowledge of plants has in every-day life, and how important a part of education it is in consequence.

—Prof. F. E. Clements in " Science," April 28, 1911.

Nicotine as an Insecticide. NICOTINE wash was tried (at Wye College) on a number of insects at different stages of growth. Solutions have been used containing $1\frac{1}{5}$ oz., 1 oz. and $\frac{1}{2}$ oz. of 98 per cent. nicotine in 10 gallons of water, and similar solut:ons with $\frac{1}{2}$ lb. of soft soap in addition. In all cases the effect of the nicotine was greatly increased by soft soap. Nicotine and soap each killed certain of the insects, but the mixture was much more fatal than either alone. It was most effective when used against Apple Sucker (*Psylla mali*), Thrip, Cuckoo Spit, young caterpillars, and some aphides—the Plum Aphis and the Currant Aphis. The result was doubtful in the case of mature caterpillars ; and against the Turnip Flea, the Cabbage Flea and the Celery Fly nicotine was quite useless.

—" Journal of the Board of Agriculture " (England), April, 1911.

Co-operative Credit in Bengal. THE Bengal societies do not discrimniate between *productive* and *unproductive* expenditure ; the distinction observed is between necessary and unnecessary outlay. Loans are accordingly granted for marriage, * *seadh*,[1] and even for pilgrimages, since if advances for these purposes were refused, the members would borrow from the *mahajan*[2] at an exorbitant rate, and there would be no wholesome check on their expenditure.

The Registrar has found that in a large number of cases the *punchayets*[3] have cut down the amounts applied for in order to meet these expenses. This has had a most salutary effect. It is the dread

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* 1 ' Irrigation ' possibly in this case.
2 Money-lender.
3 Advisory Board of the Loan Bank.

of the opinion of his neighbours that usually drives the villager to extravagant and often ruinous expenditure on social ceremonies. But this same opinion is now having the opposite effect. Where the co-operative society exists he is compelled to restrict his outlay on these subjects, and the villagers are " no longer anxious to have feasts at the expense of an unfortunate man who has lost his father, or who marries his son or daughter ; for anything that affects that man's solvency might also affect their pockets."

—"Indian Agriculturist," Nov., 1910.

Physiography in Elementary Schools.

STUDY the physiographical features of the neighbourhood—the work of the streams in carving out a channel, and in depositing gravel, sand, and mud ; the geological outcrops that form the sub-soils with the soils lying upon these ; the perviousness of the various soils to water and their power of raising water by capillarity, correlating these with a rough determination of the proportion of stones, sand, and mud as ascertained by stirring the soils with water in a narrow glass and allowing to settle ; the difference in the hardness of the water as it falls in rain and as it issues from springs and land drains indicating the dissolving out of lime from the soil ; the trees, crops and wild plants growing on each type of soil and at different elevations. This physiographical nature study involves some out-of-door work of the pupils with the teacher. Its importance, however, is very great.

—Insp. T. S. Dymond in "Suggestions on Rural Education," Board of Education (England) Pamphlets.

The Evolution of the Botanist

THE botanist of the past generation had to make up his mind to the maximum of hard work and the minimum of salary. Those who could manage to live on the smallest possible pay could take up this life, others had to sacrifice their talents for a living wage. Research had to be done at the investigator's expense and at such odd times as he could spare from the long hours spent in making enough to live on. He usually got no chance of visiting other parts of the world to study the physiology or oecology of plants and animals in other climates or to see what other establishments were doing. Everything of the kind was strongly discouraged ; if permitted at all it had to be done at the investigator's own cost and in

his own vacations. This kind of treatment did not make for pro gress, nor make it possible for many scientific young men to enter th profession. Very different was the action of Germany and other o the continental countries. Their system was to encourage worl and workers in science. The natural result was first seen in th development of Forestry in India, where the Directors of the Indiai Forests for a considerable period as well as much of the rest of th staff had to be drawn from Germany. The same thing appears t be the case now with the great rise of Tropical Agriculture England has been asleep and is waking up but is not ready fo the emergency yet.

—H. N. Ridley, F.R.S., in the "Agricultural Bulletin" S. & F. M. States, March, 1911.

Value of Poultry Manure. POULTRY manure is generally considered to be par ticularly valuable, and analyses quoted show it t be considerably richer than that of other live stock especially in nitrogen and phosphate. In order to test the poin in practice, experiments have been made by the Cornwall C. C since 1904 with fowl manure, in comparison with other nitro genous manures. A series of quarter-acre plots were laid ou on a second-rate pasture on a medium loam soil, and the manure were applied each year in the spring. One plot received 4 cwt of superphosphate and 4 cwt. of poultry manure, and the others the same quantity of superphosphate, with respectively nitrate of soda, sulphate of ammonia, dried blood, fish guano, and Peruviai guano, the quantity of each applied containing the same amount o nitrogen as 1 cwt. of nitrate of soda. Taking the average of the six years the weight of hay produced on the unmanured plot was 9 cwt per acre, with superphosphate alone 15½ cwt. per acre and witl superphosphate and each of the other manures, including poultry manure, about 30 cwt. per acre. The average cost of the nitro genous manures was about 10s. per acre, and the increase produced by them 15 cwt. per acre. The increase due to poultry manure was 14¼ cwt., so that 4 cwt. of poultry manure is estimated to be of almost as much value as 10s. worth of the other five manures. Experiments on different crops and soils are necessary before an authoritative statement can be made as to the value of the manure, but this work has been carried far enough to show that poultry-keepers should take every precaution to guard

against waste. Compared with the purchased nitrogenous fertilizers employed poultry manure appeared to be worth rather over £2 5s. per ton.

—"Journal of the Board of Agriculture" (England), April, 1911.

The Young Teacher. I think we set our requirements too high for the young teacher. We demand much more than is really necessary. We older men forget how very little we knew when we began teaching. We act as though we felt that men must be stuffed with every detail of technical knowledge before they are ready to be sent out as teachers. We want these men to be prepared all around, and well prepared, too. This is all right enough when you are thinking of specialists to fill positions calling for a particular preparation. But when the inquiry is made for a young man to be an instructor we should go back to our own experience. We did not know much, but we got on somehow, and our classes seemed to learn from us. Yet to-day we act as though we felt we must send out young teachers who are perfect machines for any kind of botanical work. We act as though we were not sending out men with initiative and ability.

Let me illustrate my meaning by an example. A few years ago the Government sent to Nebraska for a young fellow who was not especially well prepared in botany and took him to Washington, and after a few days shipped him down to Alabama, and put him in charge of a group of men. They were studying pecan tree diseases. This man from northern Nebraska who had never seen a pecan treee, found himself in charge of a squad of men engaged in budding pecans. He knew nothing about budding pecans. But he had initiative enough to master the situation, and after a night's study and practice he went ahead as though he had been budding pecans all his life, and succeeded! I did not train that man in pecan budding; in fact I could not have recommended him as a budder of pecans. Yet he "made good," not because he had been stuffed by the right kind of knowledge, but because with his foundation of knowledge he had energy and ability. Now let us ask whether we are not setting up a wrong standard? We are thinking of how full a man is of the botany we have put into him. Should not our attitude be this: This man has made a good beginning, he has the right kind of material in him, take him and let him grow up with his work. We are putting too high a value on what

e are putting into our students, and neglecting the man himself. /e are in danger of having men grow "stale," as the athletes say.

—Prof. Chas. E. Bessey in "Science," April 28, 1911.

Mole Crickets.

LITTLE is known of the life histories and habits of our South African mole crickets. Doubtless, however, these differ little from those of their relatives of other countries. The females are said to deposit between two hundred and three hundred eggs, massed in underground chambers, sometimes at a considerable depth below the surface, and the females are credited with watching carefully over their eggs until they hatch, three or four weeks after they are laid. This brooding over eggs by insects is not a common occurrence, and that the maternal mole cricket does do so is probably attributable to the fact that the male insect is known to feed upon them. Young mole crickets feed upon the many insect larvæ and earthworms which exist in abundance in the soil, and may take as long as three years to come t maturity. Although generally regarded as carnivorous, there i ample evidence to show that these insects are just as partial to vegetable diet, and one need have no compunction in compassi their destruction. Further , in view of the extended period of li allotted to them as insects, it is seen that crops grown in lan haunted by them are likely to suffer continuously from th attack. Indeed, in Porto Rico the mole cricket is considered t most serious insect pest of that island and is reported to levy annual toll upon tobacco, sugar cane, and small crops, whicl estimated at over £20,000.

However desirable the destruction of mole crickets may b must be confessed that there are many difficulties in dealing them in actual practice. We are told that if water is thrown the ground and boards placed over the moist patches, the cri will congregate there and revel in the pleasant conditior provided, and also that they are attracted to sweetened brai is therefore suggested that the infested lands should be tr once or twice a week with the poisoned bran mash given t and, in order to make this more attractive, it is sprea ... covered with boards or sacking.

Poisoned Bran Mash.—Bran or mealie (maize) meal, 1lb., white arsenic or arsenite of soda, ½lb.; molasses, 2 quarts. If white arsenic is used it should be thoroughly mixed with the dry bran or meal and a thickish mash made by adding molasses and a little water. The arsenite of soda should be dissolved in a small quantity of hot water added to the molasses and then mixed with the bran or meal.

—Editorial Notes, "The Agric. Journal of the Union of S. Africa," March, 1911.

A Cheap and Effective Farm Gate.

HAVING quite a number of gates in various paddocks on the farm I found that constant use of the ordinary Boer gate—four wires with stick and wire loop-fastener at the top—soon brought it into a bad state. I cast about for a plan of gate that would cost very little, be thoroughly effective, not easily put out of repair, and be easy for a woman to open and close instantly. After trial of several plans I at length made a gate that answered all the requirements, and the cost was so small that I doubt if a cheaper gate could be made to give satisfaction. The ordinary farmer is not in possession of a carpenter's kit of tools, but this gate can be made with a brace and a bit, screw-hammer, and saw, most of which every man has in his yard. As it has proved such a boon to me, running a number of cattle with natives and others constantly going through the gates—opening and closing them with no light hand or attempt to save the gate at any time—I thought perhaps the idea might commend itself to others, if you think it good enough to publish.

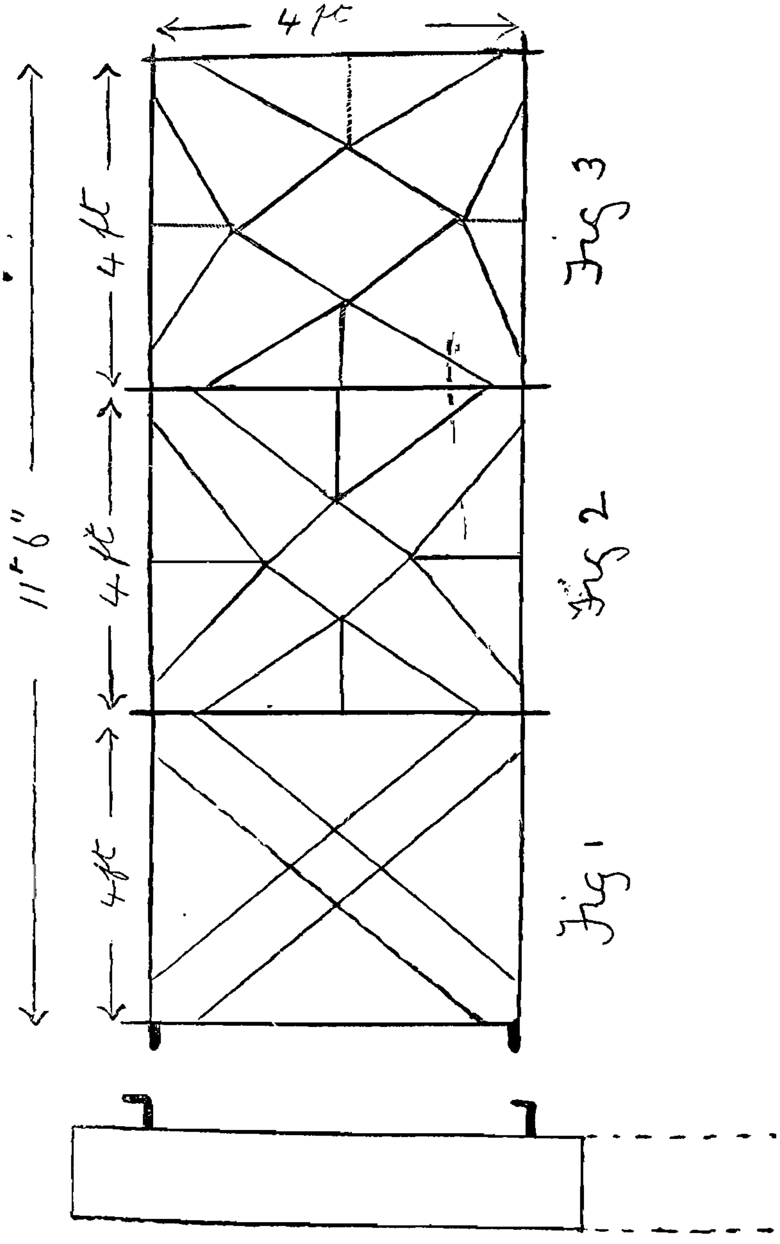
I had a clump of bamboo on the farm, which is grown by many farmers for whipsticks (the tops can be used for whips while the bottom thick part is good for gates, etc.,) so I cut down several lengths and dried them thoroughly before cutting off the thickest parts. Starting with two lengths of 11 ft. 6 in., which I laid on the ground 4 ft. apart, I then cut eight pieces of 4 ft. 6 in. each and about 1¼ in. thick. Laying these in four pairs I bolted on each side at top and bottom through the two thick pieces with iron bolts about 6 in. by ¼ in. thick. This gave me a rough skeleton of a gate with three open panels. Taking care to get the frame square, I then threaded two double lengths of ordinary fence wire cross-corner fashion round the bolts, twisting the end together as shown in dotted lines (Fig. 1, sketch).

I then stretched four pieces from top, bottom, and both sides as sketch (Fig. 2). Putting a rough chisel between the last wires I kept on twisting each in turn until every string was tight, the result being as Fig. 3. This left me with a three panel gate as rigid as a stone and free from all warp, which latter can only be prevented by careful attention to the wire twisting. Each panel looks of course like Fig. 3. I then hunted up some old pieces of large flat bolts from the scrap heap and found two with a hole at each end, which acted as a hinge to hang the gate by. These two pieces I bolted on to the bamboo as shown in the sketch, and then taking two lengths of iron rod from an old plough I bent them each to a right angle, and boring a hole in the gate-post, which I had already, I hung my gate in a second or two.

The first gate I made like this has now been in almost hourly use for fourteen months. Even an old mule, who succeeded in smashing every gate we had on the place, has been "fooled" by this one, and it is in as good order as the day I put it up. Since then I have made others on the same pattern, and as the entire cost to me for each gate totals about 3s. for bolts and wire, plus time spent in making, for which we reckon nothing on the farm as it can be done on odd wet days under a shed, I do not think a farmer can get a better gate. Even for a carriage drive it makes an exceedingly pretty gate, and when painted white, it shows much in the dark, and is so light that a child can open and close it with one hand. An additional advantage in the lightness is that when a careless person swings it back hard it has no tendency to break as a heavy gate does, and for the same reason it never sags on the hinges.

I have often wondered why some of the gatemakers do not make something similar for city use, as they could be sold at a low price and are just as effective as cumbrous iron gates which always seem to be out of repair.

—W. A. Jonnes in "Agricultural Journal of the Union of S. Africa," Vol. No. 1, Feb., 1911.


4 ft
11' 6"
4 ft
4 ft
4 ft
Fig 3
Fig 2
Fig 1

Nature Study Methods.

GET the children to grow seeds (and they can bring to school) between the side of a tumbler or lamp-glass and a piece of blotting paper fitted within. Let each child, if possible, have a separate experiment and have the responsibility of keeping the paper sufficiently moist. Let it draw the bursting seed and growing seedling day by day; never mind at first how badly the drawing is done, *it is trying to do it that matters.* Above all do not show the child how to do it, for we must avoid the possibility of the child learning to draw what it thinks it *ought* to see.

—Insp. T. S. Dymond in "Suggestions for Nature Study," Board of Education (England) Pamphlets.

Selling Eggs—and the Sequel.

AN interesting attempt to meet the growing demand for high-grade eggs is reported from America. This is a form of combination, though not co-operative in our sense of the term. A poultry-keeper living near Brooklyn City, N.Y., set himself to supply direct to consumers absolutely new-laid eggs, for which he found a ready sale at high prices. By careful breeding and management he established a prolific strain of fowls, and thus regulated to some extent the supply. His trade grew rapidly and he brought neighbouring farmers into the scheme by supplying them with eggs for hatching from his selected stock, binding them to keep no other fowls, and to sell to him the eggs obtained at stated prices, which, however, were much better than they could otherwise obtain. All eggs are guaranteed as laid on one or other of the farms included in the combination, within a few hours of delivery. At the place of receipt the eggs are packed in dozen "cartoons" or boxes bearing the name of the Aurora Farms, and are dispatched at once by vans either direct to the houses of consumers or to retailers, who deliver them with other goods in the original packages and are compelled to sell at the agreed week prices. This trade has grown by leaps and bounds. The cost of delivery and packages is somewhat high, but not so great as f each farmer delivered his own, and is much more than compensated for by the enhanced returns. At first retailers were opposed to the scheme but the best traders in Brooklyn are now glad to have regular supplies for their customers.

—Journal of the Board of Agriculture (England), March, 1911.

The Importance of "Real" Plants.

LAST year a freshman girl opened our eyes somewhat more widely on this very point. She was working with the germination of seeds in the greenhouse; after describing the steps in germination, she added naively as an afterthought, "the seeds we worked with were real peas such as you see on the table."

—Prof. Clements in "Science," Apl. 28, 1911.

Pineapples as a Catch-crop in Rubber.

[Experiments on a large scale with sisal as a catch crop in rubber are now in are now in progress at the Hills Estates, Bartica, and we are of opinion that the hemp will be found better than pine-apples for the purpose.—Ed. J. B. of A.]

A plant suitable as a catch-crop (in rubber) must have the following qualities:—

(1.) It can grow without interfering with the rubber or retarding the growth of the latter.

(2.) It must mature and fruit early.

(3.) It must not have woody roots, which may become liable to be the sites of disease.

(4.) It can be easily removed without much cost and without doing harm to the roots of the rubber trees.

(5.) It must not harbour diseases of an infective character When properly planted, pineapples fulfil the above particulars. But it is advisable not to use this form of catch-crop unless the plantation is close to a canning factory or a town where the fruit can be sold at a good price.

Dr. L. B. Keng in "Agric. Bull., F.M.S.," Sept., 1910.

Mosquitos and Pure Water.

The *Stegomyia* has therefore come to be known as a clean-water breeder; so much so, that its presence in water is taken as evidence of the good quality of the latter. From this belief has sprung a further deduction, namely, that the presence of the larvæ in water is beneficial, for it is supposed that they feed on harmful bacteria, and therefore tend to purify the water. I have made experiments to determine whether there is any truth in this belief, and I have found, as indeed might be expected, that the contrary is the case, and that water containing larvæ becomes much more crowded with bacteria than water without larvæ. The natural food of the larvæ appears to consist of minute algæ.

—The late Sir Rubert Boyce, F.R.S., in "Bull. of Entomological Research, Jan., 1911.

Visits to Country Districts.

ONDERNEEMING.

This Station was visited by several officers of the Department during last quarter. The Director, accompanied by the Agricultural Superintendent, visited in May, and the acting Assistant Director with the Economic Biologist and Government Veterinary Surgeon in June. The planting of *Hevea brasiliensis* throughout the coffee fields has now been completed and the young seedlings are making excellent growth. The tapping operations on five trees, varying in age from 5 to 9 years, are being continued and it is noticed that the operator and his boy assistants are becoming more expert with practice. The Station should prove of value in training lads to tap rubber skilfully, and when this is accomplished their services should be in great demand.

The lime cultivation looks particularly healthy, and the Nursery beds are stocked with seedlings; but the acting Superintendent reports that the demand for young plants has practically ceased, several persons who had engaged seedlings having now written to cancel orders. This is due to the Demerara Development Company having stopped purchasing limes, and is a set-back to the industry.

The cacao fields are looking healthy and the crop for last year is treble that of four years ago.

ISSORORA.

The Director and Agricultural Superintendent inspected this Station in April, and the acting Assistant Director in June. On both these occasions visits were paid to the principal rubber growing properties in the North-Western District. The Para rubber trees continue to make particularly good growth in this district, and careful girth measurements of trunks of all ages have been taken and tabulated. This is also being done in districts throughout the colony so that it will be possible to prepare a table of averages which should prove highly instructive. The *Sapium Jenmani* [illegible] well in the North West District.

so well, and in several instances it is quite evident that they are suffering from want of drainage. The trees on the old section (13 acres) are making satisfactory progress and appear perfectly healthy.

The *Sapium Jenmani* do not appear to be uniformly doing so well, a few trees have made fair growth for their age while the majority are decidedly backward. This may be attributed to the nature of the soil in this section, as in the new section mentioned above, where the soil is of a heavier nature, the few Sapiums planted have made excellent growth.

The Jackfruit trees growing in this section appear healthy and the majority are progressing satisfactorily.

PENAL SETTLEMENT AND NEIGHBOURHOOD.

The Director and Agricultural Superintendent visited the Penal Settlement in May and inspected the farm which is being cultivated by the Borstal inmates. Ground provisions such as plantains, sweet potatoes and cassava only are being grown. These were all doing well. The live stock looked particularly well: more especially the pigs, which are excellent.

Visits were at the same time paid to the Hills Estates, and the Demerara Development Company's property at Agatash. Considerable progress has been made at the former and Para rubber is being extensively planted. At Agatash the lime cultivation is doing well and Para rubber is also being tried.

PLN. NOITGEDACHT.

Tapping operations are being successfully carried on on this plantation, and the proprietor has sent some excellent biscuits of Para rubber measuring 15 inches in diameter and about $\frac{3}{8}$ of an inch in thickness to the Rubber Exhibition in London. These biscuits have been entrusted to the care of Mr. Stockdale, the Assistant Director, who is representing British Guiana at the Exhibition, and should prove a valuable advertisement of the colony.

NEW AMSTERDAM.

Visits have been paid at different times during the quarter by the ... the Assistant Director and the

in June. This is a new plantation and its appearance reflects much credit on its manager. The Para rubber trees planted ten months ago have made excellent growth, and have in many cases outstripped the plantain trees which are being grown between. The whole cultivation shows marks of careful and skilful management, and, while the exceptionally healthy and vigorous growth of the plants must in a large measure be attributed to the excellent soil conditions, careful cultivation is very evident.

COUNTRY SHOWS.

Assistant Gardener Fitz Greeves and Agricultural Assistant Morgan have visited Buxton and the West Bank District in connection with the forthcoming shows. Meetings were held and the various items on the Prize List discussed. The farmers were also given hints and advice as to the proper manner to prepare or put up their exhibits so as to show them to the best advantage. The Agricultural Superintendent has been constantly absent during the quarter in connexion with enquiries for Crown Lands for rubber.

S. H. B.

The Rising Generation.

If the majority of our boys are to become lawyers and doctors, the legal and medical professions will soon be full to overflowing. What then is the remedy ? In the opinion of all who have given any thought to the matter, the obvious solution of the difficulty lies in the people of the country turning their attention more and more to agriculture. "Back to the land" is the cry everywhere, and there is no doubt that if we do not follow the example of other countries in this respect, our rising generation will have no alternative but to accept the drudgery of ill-paid clerkships, and other equally unrenumerative callings.

—"Ceylon Independent," Nov. 2, 1910.

Cleanliness in Packing Rubber.

In Gow, Wilson, and Stanton's India Rubber market report, January, 19, 1911, we read: "Complaints are still being received on account of particles of wood, etc., which are found in some of the clean crepe. Also traces of streaky and discoloured rubber are sometimes included with fine qualities. It is most important that the attention of Managers should be drawn to these points, as they are liable to prejudice the Rubber in the market, and too much care cannot be taken to ensure that thoroughly clean and well planed wood be used for the cases.

—Agric. Bull., S. & F. M. S., March, 1911.

Planting Table.

In the last few numbers of the *Journal* has appeared a planting table compiled by the late Mr. G. S. Jenman, F.L.S. This table has been revised, and the following giving the distances at which the various crops of the colony should be planted, the width of beds and the average number of plants per acre, should form a guide for farmers :—

Crop.	*Distances between plants.* Roods	*Width of beds.* Roods	*Number of plants per acre.*
Bananas or plantains	$1\frac{1}{4}$ x $1\frac{1}{4}$	$2\frac{1}{2}$—3	192
,, ,, ,,	$1\frac{1}{2}$ x 1	3	200
Cacao	$1\frac{1}{4}$ x $1\frac{1}{4}$	$2\frac{1}{2}$—3	192
Coconuts	2 x 2	4	75
,,	2 x $2\frac{1}{2}$	4	60
Coffee (creole)	1 x 1	3	300
,, (Liberian)	$1\frac{1}{4}$ x $1\frac{1}{4}$	3	192
,, ,,	$1\frac{1}{2}$ x 1	3	192
,, robusta	1 x 1	3	300
Fruit Trees—			
Avocado Pears	2 x 2	2	75
,,	$2\frac{1}{2}$ x $1\frac{1}{2}$	$2\frac{1}{2}$	80
,, Guavas	$1\frac{1}{4}$ x 1	$2\frac{1}{2}$—3	250
,, Mangoes	2 x 2	2	75
,, Oranges	$1\frac{1}{2}$ x $1\frac{1}{4}$	3	160
,, ,,	$1\frac{1}{2}$ x $1\frac{1}{2}$	3	133
,, Sapodillas	$1\frac{1}{2}$ x $1\frac{1}{2}$	3	133
,, Star Apples	....		
Ground Provisions—			
Cassava, tannias, eddoes	$1\frac{1}{2}$ x $1\frac{1}{2}$	3	1,200
Corn	$\frac{1}{2}$ x 2 feet	3	3,600
Limes	$1\frac{1}{4}$ x $1\frac{1}{4}$	$2\frac{1}{2}$—3	192
,,	$1\frac{1}{2}$ x $1\frac{1}{4}$	3	160
,,	$1\frac{1}{2}$ x $1\frac{1}{2}$	3	133
Nutmegs	$1\frac{1}{2}$ x $1\frac{1}{4}$	3	160

(Continued.) Crop.	*Distances between plants.*	*Width of beds.*	*Number of plants per acre.*
	Roods	Roods	
Rubber (Para)	$1\frac{3}{4}$ x $1\frac{3}{4}$	$3\frac{1}{2}$	100
,,	2 x 2	4	75
Rubber (Sapium)	$1\frac{3}{4}$ x $1\frac{1}{2}$	$3\frac{1}{2}$	115
,,	2 x $1\frac{1}{2}$	4	·100

It is recognised that the above table may not be followed absolutely as the distances ultimately decided upon must depend upon the situation of the land. In no instance should plants be put closer together than has given above, and when the lesser distance is chosen it is advisable that the plants should be put in quincunx, *i.e.*, the trees of one row should alternate with the trees of the next, so that any four trees taken in the field form a diamond.

The width of the beds will vary somewhat according to conditions but it is important to recognise that if two or more rows of plants are put into one bed that sufficient space should be left between the rows of plants and the drains. The mistake of planting rows of plants too near the small drains is far too common in this colony.

The number of plants per acre has been calculated on the assumption that the two-foot drains are dug without the distance between the rows of plants on either side of these drains varying from the distance between the rows on the bed.

F. A. S.

A Bit of History.

It is a good thing to remember that Santarem is the place where Wickham back in 1871 or '72 or '73 was installing a small rubber plantation and watching for opportunity, luckily for the planters in the Far East it came, when the big British steamer "Amazonas," without cargo and without supplies to buy one, hove in sight. Wickham, practically penniless, chartered it for the Indian Government, stored baskets of Hevea seeds in its huge hold, won hasty clearance from Para for "rare botanic specimens," and got the seeds to the Kew Gardens alive and vital. Every Hevea tree in the Far East and thousands in other parts of the world are a direct result of that act. The British planters should erect a splendid monument at Santarem in honour of Wickham, but they will never do it with the consent of the Brazilians.

—Henry C. Pearson (Editor) in "India Rubber World," Oct., 1910.

The Model Gardens.

Record of Attendances.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to March 31; April 1 to June 30; July 1 to September 30; and October 1 to December 31. The totals only of the three quarters during 1907 are given: the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd to 4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
First	597	731	389	299	187	...	...	...	...	2,203
Second	1,438	860	183	274	243	...	...	...	...	2,998
Third	¶1,698	976	440	199	212	...	...	...	...	3,552
Fourth	1,714	819	465	115*	411†	160‡	...	...	...	3,684
1909.										
First	1,638	710	338	463	370	302	...	...	...	3,821
Second	1,707	677	329	142	288	446	...	...	...	3,589
Third	¶1,252	742	433	436	172	378	223‖	...	...	4,636
Fourth	1,876	536	438	236	362	771	439	...	...	4,858
1910.										
First	1,282	769	287	370	259	489	465	...	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.
¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April.

Answers to Correspondents.

S. (City). Your Bougainvillea vine has mealy-bug (*Dactilopius* sp.). Cut it back drastically and thin it out, then spray with Rosin Compound.

A. (Pomeroon).—The old method of topping Para rubber trees with a knife is not now followed; it causes an excessive number of branches, and too heavy a crown. These branches are also very liable to break off in heavy weather. A much better system is, when the tree has reached a height of about ten feet, to take off the the top whorl of leaves close to the stem. The best time to do this is when the leaves have hardened and manured, but before the top bud shoots again. This, in the majority of cases, has the effect of making the tree branch while at the same time it continues to grow from the terminal bud, thus preserving its symmetry. If this taking off of leaves fails to produce branches on the first occasion it should be tried a second time when the tree again shoots upwards and forms a higher whorl of leaves.

This system has been successfully tried at the Onderneeming Farm, about 50% of trees having responded to the first treatment while only a small number failed to branch after the second leaf-pruning.

Trees which fail to respond to the second trial should be "nail-pruned," *i.e.*, the point of growth of the trunk' pinched off with the thumb nail.

"BERBICE COURSE."—We hope to publish in our next issue some drawings by the Economic Biologist which will give you an idea of the kind of drawing required in the Agriculture examination —"large in scale and diagrammatic in treatment" as the schedules

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"BERBICE COURSE."—We hope to publish in our next issue some drawings by the Economic Biologist which will give you an idea of the kind of drawing required in the Agriculture examination —"large in scale and diagrammatic in treatment" as the schedules have it. Mr. Miall, F.R.S., has put the matter very concisely:— "From a very early stage every learner of science should practise drawing. Drawing as a branch of fine art required special gifts which are far from universally possessed, but there is a matter-of-fact drawing which ought to be known and practised *by everybody*, whether he be blessed with artistic sympathies or not. *Everyone* can learn to put on paper the true shape of a simple object, to plot curves, to lay colour in flat washes." The italics are ours, and are done to emphasize the great truth that *you* are included in the terms "everybody" and "everyone." This kind of drawing comes by *trying*, and not by "taking lessons." If you make a genuine effort

you will be surprised at the rapidity with which you will improve and the wonderful pleasure to be found in the work.

J. G. PARRIS.—We are sorry we cannot comply with your wishes. In our opinion the method you suggest is a bad one. We hope the "Lessons with Plants in British Guiana" will help you. If you find *for yourself* the answers to the questions propounded there, you will have made a good start in the right direction. No amount of correspondence can take the place of personal investigation and individual effort.

Agricultural Instructors in British Guiana.

A systematic method of arranging the reports of Agricultural Instructors has been adopted and now it is possible to follow from time to time the progress or otherwise of the different crops on the farms and grants visited by them. After a short time, when the Instructors have become accustomed to arrange their notes for the purpose of these reports, it is expected that a further simplification will be adopted, whereby it will be possible to see at a glance the different crops cultivated on any farm or grant, their condition, the advice and instruction given to the farmer, and afterwards whether or not this advice or instruction has been followed.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

Fungus Diseases in the Tropics.

A consignment of diseased specimens recently received from the Gold Coast provides further demonstration of what is yearly becoming more and more certain, viz., that the diseases of cultivated plants are caused by the same species of fungi throughout the tropics, though the truth has been obscured either by attributing them to the wrong fungus or by giving the same fungus different names in different countries. A root disease of *Funtumia* was clearly caused by *Hymenochæte noxia*, and a root disease of *Hevea* showed a mycelium which was indistinguishable from that of *Fomes semitostus*. There was no fructification in the latter case, and therefore an exact identification was not possible, but had the root been a Ceylon specimen, there would have been no doubt about it.

T. Petch, B.A., B. Sc., (Govt. Mycologist) in "Tropical Agriculturist" (Ceylon), Sept., 1910.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to June 30 (1911). The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1908	1909 Jan. 1 to	1910 June 30.	1911.
Sugar, tons ...	38,138	41,130	30,262	30,368
Rum, gallons ...	605,547	1,039,030	884,000	671,468
Molasses, casks ...	135	152	454	437
Cattle-food, tons ..	2,467	4,040	3,382	2,461
Cacao, cwts. ...	570	370	253	159
Citrate of Lime, cwts.	7·5	27·6	57·3	25·4
Coconuts, thousands	132	218	455	472
Copra, cwts. ...	—	290	141	746
Coffee, cwts. ...	564	1,120	978	685
Cotton, lbs. ...	12	—	—	—
Fruit, brls. and crates	12	—	—	—
Ground Provisions, value	$1,343 70	$134 04	$414 32	—
Kola-nuts, cwts. ...	—	38·2	9·6	—
Rice, tons ...	2,411	2,363	3,588	1,446
Rice-meal, tons ...	1,493	665	811	491
Starch, cwts. ...	—	—	4	—
Cattle, head ...	922	492	584	472
Hides, No. ...	2,434	1,814	2,881	2,201
Pigs, No. ...	—	275	444	509
Poultry, value... ...	$ 187 68	$40 48	$ 62 76	—
Sheep, head ...	7	8	69	21
Balata, cwts. ...	1,920	1,968	2,041	1,670
Charcoal, bags ..	38,672	40,159	39,028	38,130
Firewood, Wallaba, etc., tons ...	3,807	4,185	5,267	5,893
Gums, lbs. ...	519	6,308	759	2,518
Lumber, feet ...	25,189	71,072	106,603	243,085
Railway Sleepers, No.	500	1,500	500	2,020
Rubber, cwts. ...	35·6	19·7	7·2	17·3
Shingles, thousands	1,806	740	981	1,473
Timber, cubic feet	131,662	187,161	181,813	127,706

Selected Contents of Periodicals.

British Guiana and India-rubber.

—The India-rubber World : June & July, 1911.

Tea Tortrix (Entomological Notes).
School Gardening in Ceylon.
Cultivated Rubber interplanted with Cacao in W. Africa.

—Tropical Agriculturist, April, 1911.

Broom Millet.
Papaw Culture in the Philippines.
Preserving Eggs.

—Queensland Agricultural Journal, May 1911.

The Occurrence of Burrs on the Trunk of Hevea brasiliensis (May.)
A Thread-blight on Para Rubber (April).
Science and Agriculture.
A Rubber Smoking House.
Some Suggestions (March).

—Agricultural Bulletin S. and F. M. States, 1911.

The Banana and its Culture in Jamaica.

—Bull. Department of Agriculture (Jamaica), Vol. 1, No. 4.

Methods of Pruning and Training the Vine (The Wine Industry in Southern France).
Tobacco Culture : Curing.
Bees and the Fertilization of Fruit Blossoms.

—Journal, Department of Agriculture, Victoria (Australia)
—April 1911.

Progress of the Sugar Beet Industry in Norfolk.

—Journal, Board of Agriculture (England), June, 1911.

Diseases, Ticks and their Eradication.

—The Agricultural Journal of the Union of S. Africa, May, 1911.

Cultivation and Preparation of Castor Seed.
Utilization of Para Rubber Seed.
Guano Deposits (*Seychelles*).
Preparation of Calcium Cyanamide and its uses as a Manurial Agent.

—Bulletin of the Imperial Institute, Vol. IX. No. 1.

THE JOURNAL
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OF
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VOL. V. OCTOBER, 1911. No. 2

Co-operative Credit for the Colony.

It is with some little satisfaction that we are able to record that the principle of co-operation is at length to have a full trial in British Guiana. Readers of the *Journal* will perhaps remember our articles dealing with various phases of this important subject: "Some Local Aspects of Co-operation" (Jan., 1910), "Mutual Insurance of Live Stock" (April, 1910), "Agricultural Banks and Co-operative Societies" (July, 1909), "Agricultural Banks and Government Aid" (April, 1909): and will give us credit for having persistently kept the topic in the foreground. The practical realization of the principle the colony owes to its Governor, Sir F. M. Hodgson. He appointed two Committees, the first of the Combined Court to consider the subject, and the second of a more general nature guided by the recommendations of the first; and this latter Committee, presided over by His Excellency himself, has formulated a scheme which deserves the fullest trial. We do not propose to discuss the report of either Committee; politics as such are not within the purview of this *Journal*; but the text of the second report is so clear, so sympathetic, so interesting in its grasp of the real problems involved, and promises soon to be of such historical interest, that we reproduce it here *verbatim*. It will be seen that the chief points decided on are the extension of credit to other than purely agricultural purposes, the rejection of the principle of unlimited liability, (which is the heart and soul of the Raiffeisen system), the adoption of Government aid and Government supervision, benefit to co-operative members only, interest at 12%, and the establishment of a Co-operative Credit Banks Board. With this preface, we can let the report speak for itself. "We have very carefully considered the question of establishing Agricultural Loan

Banks, or, as we prefer to call them, Co-operative Credit Banks, in British Guiana ; and from the evidence placed before us and from enquiries we have made, we are unanimous in recommending the establishment of such Banks as not only desirable but necessary in the best interests of the colony.

"We endorse what was stated by the Governor in his minute dated the 11th January, 1911, which was presented to us on the opening day of the enquiry, viz.: 'The value of Agricultural Loan or Co-operative Credit Banks is that they open sources of credit to the humblest individual; they stimulate co-operation, reduce the price of money, break down and perhaps stamp out altogether the baneful business of the usurer, teach business habits by inculcating forethought and calculation, stimulate an interest in work and encourage thrift. They are, in fact, if properly and carefully worked, valuable educational and moral factors.'

"We think that the title 'Co-operative Credit Bank' is to be preferred to that of 'Agricultural Loan Bank,' because the latter implies that the operations of the Bank are limited to agricultural pursuits, whereas, in the event of the Legislature deciding to give effect to our proposals, the operations of the Banks to be established will not necessarily be confined to loans to farmers and others engaged in agriculture. Primarily no doubt the Banks will be used for assisting farmers, but they will also be available for loans for other approved industrial objects making for the benefit of the individual or individuals concerned.

"Having decided that the establishment of Co-operative Credit Banks was necessary, the next matter for our consideration was the kind of Bank likely to be most suitable to the needs of the people of the colony—the Bank most likely to find favour and therefore to do the greatest amount of good. There are two kinds of Banks established in other parts of the world, namely, Banks with limited liability and Banks with unlimited liability—the latter are most in favour in Europe, being what are known as Raiffeisen Banks. Each member is a guarantor for the other members and mutuality of liability is the guiding principle. The Raiffeisen Bank is open to the poorest, the only requirement for membership being a warranty of good character. Such Banks are co-operative Banks in the truest sense of the word, and on that account are ideal Banks.

"But we think that Banks with unlimited liability are unsuitable for introduction into British Guiana at present. They are no doubt suitable to the more sophisticated people of European Nations who

know their neighbours, and can watch and check their work; but the people of British Guiana are not in the same position. They are averse to watching and checking their neighbours' affairs, and would not take kindly to the responsibility of having to make good their neighbours' defaults.

"We accordingly recommend the adoption of Banks in which *membership is* dependent upon taking a share or shares, and in which liability is limited to the amount of the share capital. At the same time in order that the ideal Co-operative Credit Bank should not be shut out altogether we think that provision should be made in any Ordinance that may be passed to give effect to our proposals, for the establishment of such Banks at places where it may be shown that they are required and can be advantageously worked.

"Model Rules for working Co-operative Credit Banks on the limited liability system are submitted. They have been made as simple as possible in order that they may be better understood by *those who will require to be guided by them.*

"We suggest that each Bank established in the colony should have its own membership, its own Committee of Management and be entirely independent of any other Bank. It should, in fact, stand or fall by itself. Each Bank must establish its own capital of guarantee. Such capital will consist of the value of the shares (we recommend $5 shares) taken up by members, and, if applied for, a loan by the Government, at interest at the rate of 4% per annum, of a sum in no case to exceed the amount paid up by the members in shares.

"We are strongly of opinion that when money is loaned by the Government to a Co-operative Credit Bank the Chairman of the Committee of Management should be either a Government Officer or a responsible person nominated by the Governor who should remain on the Committee so long as the Government loan to the Bank or any part of it exists.

"It is, we think, an essential feature of any scheme that loans be made by Co-operative Credit Banks only to its members, and only to them upon adequate security either in the shape of approved *guarantors or in unencumbered immovable property.* We have satisfied ourselves that at any rate in the first instance it would not be desirable to make loans at a less rate of interest than 12% per annum.

This rate we believe will suffice to pay interest upon any loan obtained by the Government as well as the necessary expenses of management and supervision. Thus, if a rice farmer requires a loan of $100 for six months in connection with his operations he will, at the end of that period, have to pay back to the Bank a sum of $106. He can, however, pay back in instalments if he so desires.

At the present time the small farmer can only obtain the means of carrying on his farm by resort to the moneylender, or, if he is a cultivator of rice, by getting a merchant dealing in rice to finance him. In the former case we find that he has to pay as a rule 1 cent per week for every dollar borrowed, that is to say, at the rate of 52% per annum ; so that, if he borrows $100 for six months, he has to pay back $126. And sometimes the terms are even higher and more ruinous. In the latter case in addition to paying a high rate of interest either in money or paddy he is generally bound by stipulations as regards the sale of his paddy and is not always free to sell at his own terms in the open market.

" It is clear from the evidence before us that if the Banks charge interest at the rate of 12% the sum to be paid for a loan will be nothing compared to that which has to be paid at the present time, and farmers will have the added benefit that they will be under no obligation to sell the fruits of their labour to any particular individual or at any given time.

" We strongly recommend that the accounts of Co-operative Credit Banks should be subjected to a periodical audit by an approved auditor.

" The evidence which accompanies this report speaks for itself. With regard to that referring to money-lending transactions it is clear to us that the peasant proprietor will never advance under present conditions, and that his only chance of salvation lies in his being able to obtain money under suitable guarantee, at reasonable terms and without harassing conditions.

" Very important facts were placed before us by Officers of the Victoria Loan Bank Association, the Negro Improvement Society Loan Bank at Rosehall, and the Buxton Loan Bank started under the auspices of the Buxton Farmers' Association. From the evidence given with respect to these Banks it is clear to us that the principles under which Co-operative Credit Banks are worked are already known to a limited extent and that the people are beginning to recognise the benefits which such Banks can offer. The work

of the Government in establishing Co-operative Credit Banks will under the circumstances be the easier.

"We suggest that an Ordinance be passed to give effect to our proposals and we think that in carrying them out the Government should proceed with great caution. What is wanted is to teach people the value of co-operation and the advantages of thrift, and this cannot be done by establishing a large number of Co-operative Credit Banks simultaneously and providing loans of money in profusion. Where there is a demand for such banks, there should the requirements of the people be looked into and if a sufficient number is found agreeable to conform to the rules, then a Bank might be started. But in the first instance it would be advisable in our opinion to start with two or at most three Banks as object lessons, and preferably to start by taking in hand the Co-operative Credit Banks already in existence if the members of them are willing that this should be done.

"Once it is clearly shown to the Government that the people desire to co-operate and to obtain the advantages attaching to co-operation, that Banks can be worked without loss to the Government and with benefit to the people, and that the system is understood and suited to the requirements of the colony, an extension of the system becomes easy and can be made at comparatively short notice and with little risk.

"We recommend that there should be a Co-operative Credit Banks Board for the purpose of dealing with applications, supervising the arrangements for the loaning and repayment of Government money and advising the Government generally, and that this recommendation should be embodied in the Ordinance.

"We further recommend that the rules of each bank should be made subject to the approval of the Governor-in-Council.

"In submitting this report we express the hope that the Government will recognise the value which Co-operative Credit Banks will be to the people of British Guiana and in their interests will authorise a trial being made of them."

Agricultural Credit in Other Lands.

WE have denied ourselves comment on the proposal to establish Co-operative Credit Banks in this colony, but in the place of it we offer our readers a very striking summary of what is being done in other countries in the matter of financial aid to the struggling agriculturist. For this we are indebted to the *Colonial Office Journal* which is under the capable editorship of Mr. W. H. Mercer, C.M.G., and Mr. R. V. Vernon. We are glad of the opportunity to reproduce an article which must be of great interest to all in British Guiana who wish to study a subject of the highest importance at the present time.

"In our July number, last year, we referred to the proposal to establish Agricultural Banks in Ceylon and to the Indian practice, and the subject is being discussed in many other places where agricultural developments are kept back by want of capital. It is a universal fact that men are willing enough to farm if they can get a little help, but if they have to pay a high rate of interest they must struggle hard to make a living. The security which they can offer is, however, usually sound, and justifies special methods. There are now many established cases in which the agricultural credit system has been financially successful and has greatly stimulated production. In Australasia there has been considerable experience, the policy being a general one. The limits of the advance vary from £800 in Queensland to £5,000 in South Australia and the interest charged from 4½ to 5 per cent. The security is a first mortgage, and the advance is restricted to a proportion of the improved value, which varies from one half to three-fifths. Repayment is to be made in 25 to 42 years. The Banks or Boards making the advances are practically Government Departments, but the form varies; thus in Victoria the management is vested in the Sinking Fund Commissioners, in New Zealand there is a Government Advance Department. and in other States there is a State Bank with statutory powers of raising money. The first matter to look at in considering the results of the policy is the extent to which the repayments due have been made. In this respect the Australasian experience has been very gratifying, the failures being extremely few and unimportant, and even in the rare cases where farms have had to be seized and sold, no appreciable loss has been incurred. But obviously the success of this method depends mainly upon the prosperity of the agriculture of the country. In Australasia this has been very great, as is shown by the great increase in the exports of agricultural produce. The

thriving settler has no great difficulty in paying interest and instalments. It would be rash finance to lend money on the large scale adopted in Australasia on agricultural undertakings of a dubious character. The State must make sure that it has good security, and this depends not merely on the ratio of the amount to the nominal value of the land, but on the prospects of the undertaking. It is also essential that the farmers as a class should be honest, and should appreciate the character of the transaction. In some cases advances are made on a stereotyped plan and without much enquiry into personal considerations ; thus in Western Australia the Government Agricultural Bank advances up to £400 without any security except the land upon which the settler has paid 3d. an acre. But the necessary conditions are amply satisfied in Australasia. Then in New Zealand, by the 31st March, 1910, the capital advanced (in a period of five years) was £9,343,660 of which £3,680,686 had been repaid, and the overdue payments were only £4,659 for instalments, and £18,189 for interest.

The cost of management was 0.15 per cent., and in the year ended 31st March, 1910, the net profits were £41,833. The weak point in the Government system is that political influences may be brought to bear on the management, even though the officials are nominated by the Governor. Then it is said that in Queensland the Labour Party are not satisfied with the operation of the Agricultural Land Bank, charging the Trustees with a want of sympathy with farmers. Naturally the party that lends and the party that borrows look at the matter with different eyes. But amongst an intelligent population things are not likely to go far wrong. There is no doubt that the system has stimulated agricultural production remarkably. It is the universal opinion in Australia that the great developments of recent years have been mainly due to it. As constituting a Government investment, it goes hand in hand with Government works helping agriculture. Vast areas in Australia will grow almost anything if given water, and this prime requisite is being provided and sold to land-holders by Government, at prices which make irrigation in Australia probably the cheapest in the world.

The Continental or "Raiffeisen" method has the same object but is on a quite different principle. Raiffeisen was mayor of a Rhine province where the peasant proprietors were largely the prey of Jewish usurers. He induced nearly all of them to form an unlimited liability society for the purpose of borrowing money on their joint credit and lending it at reasonable rates. The strength of this system consists in the unlimited liability. Capitalists and bankers are

willing to lend money on this security, knowing that every precaution is taken to ensure that money advanced shall be properly employed. The safety of the system depends on close supervision of the borrowers. Each association consists of a small number of members, resident in the same district, and knowing one another personally. In the early cases the borrower had to find someone to go bail for him, but this is not an essential characteristic. The association is so strictly local that the members know one another's proceedings. The direct interest which each has in the fund and the administration is found in practice to strengthen individual energy and encourage a healthy condition. Both the social and the economic results are good, and the small peasant who has lived in isolation and ignorance is raised to a position in which he takes a large interest in public affairs and becomes accustomed to the responsibilities of practical administration. Financially the system works well. The association has no inducement to go beyond its legitimate business or to seek for new outlets. When the work of the district is accomplished it is usually wound up. This method is well adapted to districts where small culture is practised, but it requires the presence of a few educated men who will explain the idea, obtain support from the banks, and keep the accounts. But the very local and limited nature of the undertaking makes it unnecessary to have such skilled management as has been found necessary for ordinary co-operative societies. So the cost of administration is trifling.

Another method is in existence in which each member must take shares and his liability is limited to them. This seems more in accordance with commercial principles, and has the advantage of raising an initial capital. But it loses the backbone of the Raiffeisen system. If you abandon the features of unlimited liability you abandon the necessity for care and watchfulness. The lending of money is not watched when each member's liability is limited to a trifling sum as it is when the liability is unlimited. The element of family interest in the concern is gone. The reason why many Continental associations have shares is that the German Government insisted on it, but the associations usually make them practically nominal.

It will be seen that the Raiffeisen system is only suited to small areas and small proprietors. It would be impracticable in those colonies where the population is widely scattered and composed of different races. In such places the close knowledge and feeling of fellowship, which are essential conditions, are not to be

found. But there are numerous places where there are to be found, at any rate, with proper encouragement, and without imparting an official character to the undertakings, Government officials could do much to initiate and supervise them. The Raiffeisen system has been closely followed in India, with the addition of an initial Government advance and of an official audit, and the results are extremely satisfactory. Government advance is imperative where there are no banks in the field, and the logical result is the Government audit, but the advance should be limited and designed only to encourage the formation of the association.

The case of the advances made under the Hurricane Loans Laws of Jamaica (1903) is very useful as showing the results of a system which was introduced for a special occasion but which might be the foundation of a wider application. There local committees were formed whose function was to advise whether repayment could be made and to see that the money was properly applied. It was found that persons of good standing were willing to serve on these bodies, and the work was well and carefully done. Theoretically, the plan was not so good as the Raiffeisen. It involved the Government in some financial liability; it did not make repayment so secure; it excluded the poor men who were known only to their fellows. It was necessary under the circumstances, as there was no time to build up the co-operative system, and the results were distinctly encouraging for a plan of a permanent character more akin to the Raiffeisen. In British Guiana, on the other hand, the scheme proposed last year by a Committee of the Combined Court was entirely of the Government order. The Committee felt the difficulty of securing co-operation and raising capital, and accordingly recommended the formation of a Bank as a Government institution. They suggested that loans should only be granted on approved security, though they realised that some persons desiring assistance might find it difficult to furnish it, and that the services of the Village Councils and Local Authorities might be utilised for obtaining information for the assistance of the Board of Management. The large areas and mixed population of the colony, no doubt, make the Raiffeisen system impracticable, and the liability to both floods and severe drought put purely local schemes out of court. In Grenada, on the other hand, a recent committee recommended the system of Government advances to local societies in preference to the establishment of a Government Bank. "We have given," they said, "the proposals put forward on this subject the most careful consideration, for we believe the formation of a people's land bank would be pro-

ductive of a great amount of good, and would lessen, if not do away with, many oppressive burdens on landowners with insufficient capital. The experience of the Government in the sales of land for unpaid taxes, in which instances frequently occur of valuable lands remaining unsold, or being sold for insignificant sums, convinces us that it would be extremely undesirable for the Government to undertake to run a Land Bank. We see no reason, however, why the Government should not advance funds to local credit societies established on the principle of mutual unlimited liability of the members. It is this principle which is the secret of success in all the people's land banks in all the countries of the world where they have been established and are flourishing. This safeguard against the improper advancing of money is in our opinion as essential in Grenada as in any other country. The absolute security thus afforded to investors attracts money at a lower rate of interest than can be secured by almost any other organisation, and the members of the bank thus obtain the maximum benefit from their co-operation."

A more advanced form of Government encouragement is the purchase of estates and a scheme of land settlement under which the purchase price is spread over a number of years. This policy is suitable, generally speaking, to the great population of the West Indies, and at a critical period, intensified by a destructive hurricane, it was acted on in 1897 in St. Vincent. An Imperial grant-in-aid of £15,000 was expended on the acquisition of land, and plots were sold on payment of 25 per cent. of the valuation, the remaining instalments being spread over 12 years. The scheme has been a financial success, and is being extended. This plan is especially suitable when, as in the West Indies, the Government can give instructions as to the products and work of cultivation, as in this way it can ensure that the land is suitably worked.

The operations of an Agricultural Bank may extend beyond advances to settlers, and embraces schemes for the general benefit. Then supplies of necessaries may be bought more cheaply by a central body, and in Barbados it is now proposed that the Agricultural Bank should raise the money required for a central factory and undertake its management. These branches of business are, or may easily become, somewhat speculative, and are outside the ordinary character of such a bank; in this country and on the Continent they are undertaken by separate co-operative bodies; but in undeveloped countries where co-operation is not easily arranged, such extensions of operation may be quite legitimate. It is now proposed in India to provide, by an amendment of the law, facilities for co-operative purchasing and production."

Notes.

Moth Borers. It is now a universally accepted fact that insect pests such as the Giant Moth Borer (*Castnia licus*) and species of the small moth-borer by no means confine their attention to the sugar cane. The small Moth Borer (*D. saccharalis*), whose natural food is grasses, has lately been discovered doing considerable damage to the experimental rice fields at the Botanic Gardens. Boring into the stem of the plant at a distance of a few inches from the ground it penetrates up to the growing point, eventually killing out the whole shoot. Its ravages were checked to a certain extent by means of trap-lights set up at different points and also by cutting out all dead or dying plants which contained either a larva or pupa. Several instances of parasitised eggs were met with. The Giant Moth Borer, apart from its ravages in the sugar cane, has already been reported as attacking plantains. Its latest development, however, has been the destruction of very young coconut palms. The larva bores a hole through the stem just above where it emerges from the coconut, eating out the entire centre of the shoot and killing the plant. Damage to young palms is also often occasioned by a Beetle (*Strategus alveus*).

G. E. B.

Insect Pests of Hevea Brasiliensis. Up to the present time Rubber trees in this colony have not suffered to any extent from insect attack. All planters of rubber should, however, maintain a careful watch over their trees and any outbreaks of this nature should be notified and measures taken for their suppression. Species of scale insects seem to be the most prevalent pests and several have been sent in for identification. The most harmful of these is *Planchonia fimbriata,* a greenish yellow coloured scale with a pinkish fringe, which attacks the younger shoots giving them a characteristically 'warty' appearance, and often causing their death. In the centre of each of these eruptions a scale will be found. The presence of this insect should carefully be watched for and remedial measures taken to prevent its spread. The timely application of a good Rosin Compound wash will prove effective. The wash described for use against scale insects on lime trees in *The Journal* of July, 1910, Vol. IV., No. 1, is an excellent one. Spraying

should always be performed in the early morning, before the sun reaches its full strength. Another species of scale (*Lecanium*) is also fairly prevalent. It is a dark, hard-bodied scale and although not doing so much damage as the one mentioned previously, should be kept well under control. This can be done by means of the Rosin wash described above. Acoushi Ants often do considerable damage to young trees, in some cases completely defoliating them. Their nests should be looked for and destroyed by means of carbon bi-sulphide. This should be done in the following way. All holes leading to the nest should first be closed with earth or clay. Several holes should then be bored to a depth of about 1-2 feet in the centre of the nest, and about 2oz. of carbon bi-sulphide poured into each hole, the holes being immediately plugged with earth. Exploding the bi-sulphide with a match is unnecessary as much of the vapour is lost, not to mention the danger of the practice. The larvæ of two varieties of hawk moths (*Dilophonota ello* and *Pseudosphinx tetrio*) have been discovered feeding on the leaves of young rubber trees. They are large, not numerous, and easily discernible, consequently they may be kept in check by hand picking. Both these varieties are found feeding on other economic plants such as Indian corn and cassava. A species of locust (*Tropidacris cristata*) is troublesome in some districts, defoliating the trees. They are large insects with the upper side of the abdomen a bright red, the underwings are a beautiful blue colour. They may easily be caught by hand and destroyed. Up to the present, however, they have not appeared in anything like large enough numbers to warrant special remedial measures being taken such as spraying with arsenical washes or the use of poisoned baits. As a possible danger to the cultivation they should be carefully watched.

G. E. B.

Keeping a Pure Strain of Hevea Brasiliensis.

At the meeting of the Board of Agriculture held on October 24th Professor Harrison pointedly called the attention of all planters of rubber to the danger which existed of the wild Heveas of this colony causing serious depreciation in plantations of Para rubber trees. He pointed out that the danger of the wild nature species crossing with the imported *H. brasiliensis* must be kept always in mind, and urged that the only safe plan was to exterminate all "Hatties" in the neighbourhood of Para rubber estates. While there was no risk to the Para trees actually established, there was much for the future. The crossing of the species might give seedlings which in the second generation would probably

split up into a series of forms among which the characters of the native parents might predominate ; and as none of the local Heveas were known to produce commercially valuable rubber, a large portion of such seedlings would be valueless. Again, owing to the method by which the capsules of the Heveas, when ripe, burst and scatter their seeds considerable distances, seed collected on such a ' mixed ' plantation could only be used or sold at considerable risk, for it was doubtful if even an expert botanist could separate satisfactorily in bulk the seeds of the different species of Hevea. The point was thoroughly appreciated by the Board ; who were so impresssed by its importance that they desired that wide publicity should be given to it, especially among local rubber planters.

Poisoned Pumpkin Pips for Rats.

SIR,—I am in perfect agreement with Mr. Eagle that rats and mice can become a terrible scourge, not only in the warehouse and the field, but, as he remarks, often as the carriers of loathsome and infectious diseases. Hence the war that is being constantly waged against them.

I have no doubt that the remedy he suggests is a very good one, so long as there is no other food to tempt. But rats, like human beings, are very fastidious at times, and when they have a choice of foods, go for what they like best. For instance, I had a rather extensive plantation situated in a rocky kloof which afforded rats protection, and almost as fast as I planted they destroyed. Like Mr. Eagle, I resorted to Cooper's Dip put in bread, mixed with boiled wheat, and in others forms. I also tried all the other known destroyers that I could think of, without making any appreciable headway. The work of destruction still went on, and I began to despair. As a last resource, knowing the preference they had for pumpkin pips above everything else, I tried these, steeped in a strong solution of arsenic, with the result that I made a clean sweep of the rats, and I had the satisfaction of seeing them dead or dying in scores all over the place. I subsequently visited a friend who had also put out a large number of trees on a stony kopje heavily covered with grass, but with one or two exceptions, only the small stumps were left, whereas after this clearance mine grew to great perfection.—Yours, etc.,

E. R. Bradfield in Correspondence Column of the "Agric. Journal of the Union of South Africa," June, 1911.

Lessons with Plants in British Guiana.

[" *It is finding answers to questions which chiefly deserves to be called Science.*"—L. C. Miall, F.R.S., in "Teaching and Organization."]

II.

THE HIBISCUS AND ITS RELATIONS.

(*Continued.*)

LEAVES.

Before we leave the Hibiscus we must study a little more particularly its leaves and stem. Taking a number of leaves it is instructive to place them on a sheet of paper and run the pencil round the margin of the *blade* (for it will at once be observed that the leaf of the Hibiscus consists of a broad green piece or blade and a stalk or *petiole*) but it is still more instructive if each leaf is placed upon the drawing of the previous one so that their bases coincide. This method will bring home to you the great variety in shape and size that exists among the leaves of even one branch. Do not omit from your drawing a plan of the chief veins which you will observe running through the leaf blade, making quite certain of their number and position. Draw a small part—say a square inch—of two or three leaves in detail, and note exactly how the smallest veins are arranged. Now study your drawings. Do you find any two leaves exactly alike? How are the big veins arranged? It is usual to classify the venation of leaves in two divisions; one in which the smaller veins spring from a central one (the mid-rib) like the barbs of a feather, and the other in which several veins of much the same size arise from a single point at the base of the leaf, something after the fashion in which the fingers spring from the palm of the hand.

"PINNATE" AND "PALMATE".

The first is called *pinnate*, the second *palmate*. To which of these classes do you judge that the leaf of the Hibiscus belongs? Or does it appear that the venation is "mixed"—that is to say that the pinnate style prevails in one part of the leaf and the palmate in another? Perhaps you may consider that some leaves should undoubtedly be placed in one class or the other. Such a question can only be decided by your own observation carefully applied

to the specimens before you. Other points in the description of the leaf are its shape—whether "lance-head" shape, or "egg-like" (that is to say broader at the base than above) elliptical (with its broadest part in the middle) "round," (or circular in outline) heart-shaped, or one of a dozen other forms which we need not trouble about for the moment as the Hibiscus leaf will probably be found to come under one of the forms specified; the colour and nature of its two surfaces, whether rough or smooth, hairy or scaly, and whether the colour is the same on both surfaces; the character of its edges or margins, of its base and of its point or apex. In the case of the Hibiscus the toothed nature of the margin of the leaf and its pointed apex are usually quite conspicuous.

Now let us study the stalk of the leaf for a moment noticing its colour, shape in section and approximate length. Trace it to its junction with the stem. We already know what to expect to find in the axil—one or more buds of some kind—but what other structures do you discover on a careful examination? A typical leaf is usually said to consist of blade, petiole and *stipules*: do you see anything to which you could apply the word "stipule"? If so, of what nature is it? Describe it or them in the same way as you have the leaf. Remember that when you are dealing with shape or size—everything, in fact, except colour, and then coloured chalks or paints are a great help—a drawing is worth a whole page of written description. The resources of language can hardly be expected to keep pace with the infinite variety of Nature.

THE COMPARATIVE *METHOD AGAIN.*

But our method, as we hope we have already made clear, must be comparative if we are to get the full measure of instruction from it. We have already been introduced to several plants related to the Hibiscus; obtain leaves of hibiscus, mahoe (the trees you have found growing on the Kitty sea-dam) ochroe, sorrel, cotton and of the silk cotton tree and make careful drawings of each in the manner already explained, only in this instance put the drawings side by side instead of one on top of the other. Put the chief veins in carefully. Now study your pictures closely, comparing one with the other. You will observe that certain leaves have a tendency to become divided into *lobes* and that the division may extend almost to the base of the leaf. In one of the specimens before you—which is it?—the division has gone so far that the leaf is *completely divided* into separate *leaflets,* each having a little stalk of its own. In this way we reach the idea of a *compound leaf*—that is, one in which the leaf blade is completely divided into two or more parts—and we can

imagine how such a compound leaf could arise from a simple leaf *of such an indefinite character as that of the Hibiscus.* And we can see that even the compound leaf is a single structure arising from a single bud but bearing no buds on itself; having a bud in the axil of its petiole but not in the axils of the stalks of its leaflets. Thus we discover what appears to be a good guide for the future when examining other leaves—*look for the bud ;* that will be in the axil of the leaf, and everything outside the bud must be leaf, however much divided it may be. We shall test the value of this rule later on.

THE STEM.

Now examine the stem, following the branch from its tip downwards. Is it all the same colour ? Examine its surface ; do you see any noticeable marks upon it ? If so, describe them and say on what part of the stem they occur. Take your knife and cut sections at different points of the stem. Note the behaviour of your knife as it enters the stem. Is the hardest part of the stem outside, or not ? Scrape the stem at various points and describe what you observe, and study—making careful drawings—the sections of the stems you have made. These sections should supply the explanation of what you have observed.

Sections of such a plant as the Hibiscus usually show a ringed structure. Can you confirm this ? If so, how many rings can you make out ? Peel off the "bark" from one or more of the little cylinders of stem that your sections will have made. Rub your finger along both the inside of the bark and the outside of the woody core. What do you observe ? Make a careful note of this for it is important. Now try and tear the piece of bark across ; then try and tear it lengthways. Which is the easier to do ? Now try and break the woody core across, and observe its behaviour. Take a fresh branch and try to break it across. What happens ? These experiments will give you some idea of the nature of the Hibiscus stem ; and you will find it instructive to peel off the bark from such a branch, soak it in warm water, and let it decay. After the lapse of a week or two examine it again and you will probably find the reason for the behaviour of the Hibiscus stem when broken and of the value from an economic point of view of the Hibiscus, of the "jumbi *ochroe*" and of many other plants of this natural order. Make similar sections and similar experiments with the stems of ochroes.

THE 'MUCILAGINOUS' OCHROE.

The garden ochroe should then reveal another characteristic

of the family. What do you observe when you soak it in water or when you prepare the fruit for cooking ? The ochroe stem, too, is worth comparing with that of the Hibiscus. Note the difference in the character of the bark and of the wood in the two plants. This may help you to understand the difference between what are called *herbaceous* and *woody* stems. A useful way to record such observations is in tabular form. Put down in one column, under the head of ochroe, the characters of that stem, and under the head of Hibiscus the points you observe in a woody shrub. In each case you will probably be able to make out a *pith* in the centre of the stem, a ring of *wood* surrounding that, then a *cambium ring*, then a ring of 'bark' and outside of all an *epidermis* or skin. Note particularly carefully the differences in the bark and epidermis. In the ochroe you should be able to see some tiny, dark, transparent spots (the cut ends of "mucilage" cells) which may explain the "gumminess" of the ochroe when moistened with water. Further details you will be hardly able to make out properly without a microscope ; but we hope to be able to help you in this respect very shortly by publishing drawings of sections of these stems in the *Journal*. For the moment we have done as much as we can along this line of investigation.

THE ROOT.

There still remain the root and the fruit of the Hibiscus to study ; but as you are not likely to have the chance of pulling up so useful an ornamental plant and as fruit is not commonly set by the garden Hibiscus you may fall back upon the ochroe or the sorrel for specimens. In this case also the contrast between herbaceous and woody plants is well brought out. When making your observations on the root, note how much force is required to pull up a specimen ; this will give you some idea of the anchoring function of the root ; observe whether the stem ends off short or seems to go straight down into the ground as a *tap-root* and whether the secondary roots spread out on all sides or not. Observe how far and in what direction the roots run ; try and make out, by cutting sections with your knife, the structure of the root, and compare it with that of the stem. Very instructive in many cases is a series of transverse and longitudinal sections made in the lower three inches of the stem and the upper three inches of the root; that is to say, just above and just below the soil-line. What becomes of the pith ? Which is the hardest part of the root ? Is there a considerable thickness of 'bark' ? Above all, whereabouts in the root do the young roots or rootlets arise ? Careful longitudinal sections will show this very well. In some cases, no doubt, you

will actually be able to find young roots pushing their way out from the *central cylinder* of the parent root but not yet showing outside the *cortex*. Compare such sections as these with longitudinal sections through the stem at a *node*; that is to say, at the points on the stem where the leaves grow. We have already found buds (which give rise to branches of the stem) in the axils of leaves. Compare, then, the origin of branches with the origin of roots. It will be interest to find out whether the methods we observe to prevail in the Hibiscus and its family obtain in other plants. We may find these observations useful later on when we have to determine whether a given structure is a stem or a root.

ROOT-HAIRS AND THEIR WORK.

One warning is necessary: your text books tell you of *root-hairs*, do not be deceived by the last fine hair-like branches of the rootlets into thinking that these are root hairs. Root-hairs are *unicellular* (that is, one-celled) outgrowths of a small zone just behind the growing point of roots and rootlets, and are so delicate that it is impossible to pull up any plant growing in the ordinary stiff clay soil of this colony without destroying them utterly. The fine hairs you see are rootlets and under the microsope will be found to be *multicellular* (i.e., "many celled") and to have the structure typical of roots. It is necessary to emphasize this point as much confusion seems to exist regarding it in this colony. In a very light, sandy, or leaf-mould soil—such, for instance, as that in which *Hevea brasiliensis* seeds are germinated in the Nursery at the Botanic Gardens—it is possible to demonstrate the root-hairs when a plant is very carefully uprooted. The particles of soil stick to the root-hairs and show their position. But the best way is to germinate seeds on damp blotting paper; and for this ochroe seeds do very well. Root-hairs will be seen as a white fluffy outgrowth looking almost like mould or fungus just behind the root tip. The absorptive power of the root lies wholly in the root-hairs, and an interesting experiment can be made to illustrate this. Take a young healthy plant of ochroe and dig it up with the greatest care so that absolutely no injury is apparent either to the root or to the stem or leaves when it is transplanted to a flower-pot or a fresh place in the garden bed. Water it well and shade it judiciously. Note carefully what happens and how long it takes before the plant recovers its normal appearance. Does the plant give any evidence of suffering from want of water, although generously supplied with it? And does this result seem out of all proportion to the extremely small amount of damage done to the plant by moving it? Would what

we have said about root-hairs and their delicate structure account for it, do you think ?

INVENT EXPERIMENTS YOURSELF.

Try and devise for yourself experiments to discover the functions of the root. For example, water a spot some distance away from a plant growing in a very dry bed, and after some time dig up the plant and note whether there is any indication that the roots are growing towards the moisture: water a plant copiously for some days and early in the morning cut through the stem a few inches above the ground. Note carefully what you observe. You may combine this experiment with a simple one on leaves. Choose a sunny day and place over a young plant (which has been well watered) a dry tumbler or glass jug taking care to cover the ground right up to the stem with a thick piece of brown or blotting paper. Again note carefully what you observe. It is by such experiments as these that we discover what a great part water plays in the life of a plant, and a little thought will enable you to understand why it is that the plants in your garden at mid-day, after the hot sun has been beating on them for several hours, look "wilted" as if they were suffering from lack of moisture.

THE FRUIT.

Now let us turn our attention for a few moments to the fruit. Get specimens of the fruit of the ochroe, the sorrel, jumbi ochroe, the mahoe from Kitty and of the silk-cotton tree. As you have already studied the *ovaries* of these plants you will find it easy to trace the development of the fruit, especially as some plants, probably, will afford you specimens in all stages of growth. There are many points of interest to observe. Is the number of divisions in the ripe fruit greater or less than the number of carpels in the ovary ? Do any of the parts of the flower continue to grow with the developing ovary and form part of the fruit ? A fruit has been defined as "a ripened ovary with its attachments." How is this definition illustrated by the fruits before you ? Definitions are dangerous things in Science, for you will soon find how impossible it is to cramp Nature into a formula, but occasionally they are useful as pegs, as it were, on which to hang our knowledge. Several of the fruits of the Hibiscus family are economically useful either for food or other purposes ; a short but careful investigation will show you just what parts of the ochroe, the sorrel, the cotton, and of the silk cotton are used by man. Another point to be noticed is the method in which the fruit when ripe splits or *dehisces*. Look

carefully at the *capsules* before you and note whether they split along the lines between the carpels, or by a crack in the wall of the carpel itself, or by both ; and note what effect the method has upon the liberation of the seed. Watch carefully a fruiting plant of ochroe or sorrel and try to find out how far the seeds are scattered when the fruit splits and how near to the parent plant the young seedlings grow. Compare what you discover with the behaviour of the cotton and of the silk cotton tree. Could you prove by experiment that the "wool" of the cotton and of the silk cotton is of any use in carrying the seeds of those plants some distance and so preventing the competition of the young seedlings with their parent ?

NOT A CATALOGUE.

Now you must understand that the suggestions we have made and the questions we have put forward do not claim to be exhaustive. They are meant to be a guide and a stimulus, not a catalogue. To elaborate a set of questions which have only to be answered to acquire a complete knowledge of the plant would be but a poor method of encouraging original observation and that progressive curiosity which is the motive power of scientific work. No doubt, if you have followed the line of investigation laid down, certain points, not mentioned therein, have occurred to you and sundry questions not appearing on the printed papers have arisen therefrom. Thus, did you notice, when considering the anchoring function of the root, the splendid buttresses of the silk-cotton tree ? Did you trace the leaves on the hibiscus and ochroe to their very origin, but following them up to the growing point of the branch ? And did the longitudinal sections you made of the stem include the tip of the branch ? Did you observe whether the leaves of the young branches of red sorrel are similar to the older leaves in the axils of which they grow ? Did you notice, when measuring the petioles of the leaves, any twisting or lengthening which would bring the leaf-blade well into the light ? Such are a few of the unasked questions to which we have made reference.

THE BIOLOGY OF THE PLANT.

Moreover you must keep carefully in mind that our object is to try and understand the plant itself and how it is affected by its environment. We must treat it as a whole, as a living thing acted upon by, and reacting to, the influences which make up the conditions in which it lives. As we have arrived at the point

where the ochroe seedlings are under consideration, we may well utilize them for our lessons. You will find that the minute examination of flowers and leaves is an excellent training for general observation; and that soon you will be noticing little points in every plant you see that formerly would have failed to catch your eye. Grow, then, your ochroe seedlings in bulk and in as many different conditions as you can—but note, *in writing*, the exact date and conditions of each experiment—and carefully observe their behaviour. We shall come back to them again. In the next number of the *Journal* we propose to consider the Flamboyant, the fine "coral tree" whose blazing red blossoms and feathery leaves are such an ornament to many of the streets of Georgetown. By this time you may be interested enough and sufficiently confident not to wait for our article. The plant is there and is ready to answer the questions you put to it.

A. L.

(To be Continued.)

Wild Brazilian v. Plantation Para.

Dr. Huber remarked that he had gathered from the Conference that the superiority of the wild Para was admitted, and that its uniformity was due to the method of preparation. It seemed to be the opinion of chemists and manufacturers that the superiority of wild Para waa not in the compostion of the latex, but in the mode of preparation and the uniformity of the product. That was very important to the Brazilians.

Mr. Suter said there seemed to be considerable variety of opinion as to whether there was superiority in hard Para over plantation rubber. Owing to the youth of most of the plantations there was an insufficient quantity coming from particular estates, but this would be overcome later. It seemed to him that one manufacturer preferred one kind and others preferred different kinds. The planter thought it might prove a matter of fashion. Certainly, the manufacturers had given no reasons for the changes they made, and the planter could not tell what to aim at, and therefore simply pleased himself in the matter, suiting his own convenience. It was a young industry, and things would right themselves.

—Debate at the Rubber Exhibition, 1911.

Aleyrodidæ of Economic Importance.

WITH DESCRIPTION OF A SPECIES PREVALENT IN BRITISH GUIANA.

THIS family of insects is of frequent occurrence throughout the colony and causes more damage to economic plants than is generally realised. Systematically the *Aleyrodidæ* occupy a position between the *Coccidæ* and the *Aphididæ,* but unlike these two families they are mostly confined to tropical or semi-tropical regions, due probably to the fact that they feed exclusively on the leaves of their host plant and are thus not so likely to be distributed in shipments of trees and plants, as if occurring on the twigs and branches. Nearly all the species are omnivorous, and when once thoroughly established in a locality spread rapidly, as the adults of both sexes are winged. Several species are of very considerable economic importance, among them being *Aleyrodes citri* and *A. howardii* infesting the orange, *A. cocois* infesting the coconut and guava, *Aleyrodicus anonae* infesting custard apples, and a couple of species reported as causing considerable damage to the sugar cane in Java. The winged adults shelter on the under sides of the leaves, while the larvæ are to be found on both surfaces. Not only do they weaken the plant by sucking the sap, but their waxy secretions block up the stomata, thus interfering with one of the most vital functions of the plant.

BLACK BLIGHT.

This waxy secretion eventually gives rise to a fungus appearing as a black incrustation covering both sides of the leaves. It is particularly troublesome in the case of the orange, for here it often attacks the fruit. A parasitic fungus (*Aschersonia Aleyrodis*) keeps these insects in check to a certain extent, and in Florida the spores are artificially disseminated with excellent results. Other remedial measures consist in spraying with a good resin wash or kerosene emulsion. It is very essential in these operations that the under sides of the leaves come into contact with the spray. Spraying should take place when the insects are in the larvæ or pupal stages.

Fumigation with hydrocyanic acid gas is perhaps the most effective method of destroying these pests, but in comparison with spraying it is somewhat costly.

METHOD OF EXAMINATION.

The literature dealing with the Aleyrodidæ is very widely scattered, consequently exact identification of the species here described is not at present possible.

For the correct determination of the structure of the *Aleyrodidae* in their various stages of development it is necessary to make microscopical preparations. This was done in the following way—all larvæ and pupæ were first placed in alcohol to which had been added a few drops of chloroform to dissolve the large quantity of wax present in these stages. They were then thoroughly dehydrated in alcohol, passed through clove oil and finally mounted in Balsam. Various stains were tried without success. The majority of the drawings were made from the magnification obtained by a $\frac{2}{3}$-inch objective. The drawings of the earliest larval stage, vasiform orifice, and antennae were made by means of a $\frac{1}{6}$-inch objective.

CHARACTERS OF THE ALEYRODIDÆ.

The *Aleyrodidae* are distinguished by the presence, in the larval stage, of the "vasiform orifice," a subovate, semi-circular, or triangular opening on the dorsum of the last abdominal segment. A copious waxy secretion is present in the later larval stages. In the adults the antennae are usually 7 jointed, the first 2 joints being somewhat thickened. The tarsi are 2 jointed and the body yellowish in colour. The body and wings are covered with a white powder (Greek—Aleurodes-'-flour-like'). The adults of both sexes are winged. The family contains 2 genera separated in the following way—

1. *Aleyrodicus.* In the adults the veins in both pairs of wings have a distal and basal branch.

2. *Aleyrodes.* In the adults the vein in the anterior wing has a basal branch, but the posterior wing has only a single vein.

ALEYRODES, SP.

There are six stages through which the insect passes in reaching its maturity: the egg, three larval stages, as a pupa and finally the winged adult. The eggs are to be found on the younger leaves, laid singly, in a rough semi-circular formation, 10-15 being the usual number deposited by each female. To the naked eye they appear as minute, light brownish bodies adhering closely to the surface of the leaf. Microscopically they are .21 mm. in length and from .07-.09 mm. in diameter, of a curious boat-shaped appearance which is characteristic of the species. The colour is yellowish-brown, and the pedicel short (see illustration 1). The surface of the egg is smooth, no wax being present.

THE LARVAE.

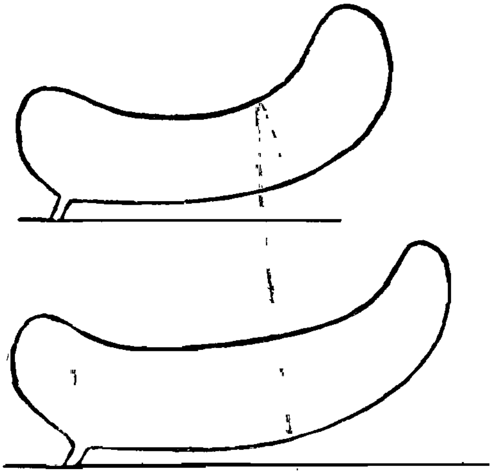
The young larvae emerge through a longitudinal slit on the uppmost surface after an incubation period of about eleven days. They are greenish yellow, .28 mm. in length and .09 mm. in breadth. The larvæ in this stage are quite active, running over the surface of the leaf. Wax soon begins to be formed,appearing as 8 small white spots on the back, the four towards the centre being the largest while those towards the head and vasiform orifice are smaller. This waxy secretion is produced by the 8 wax tubes present on the back (see illustration 2).

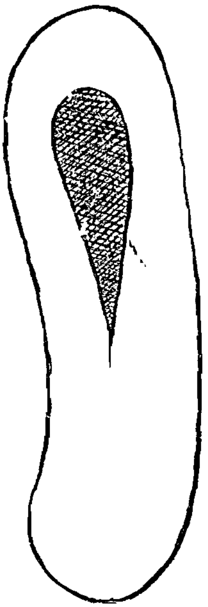
There are three pairs of short, stout legs. the tarsus in each case being provided with a single claw. (See illustration 7.) Some 17 marginal hairs are present. The vassiform orifice is easily discernible as a semi-circular object on the last abdominal segment. The one pair each of eyes and ocelli are well marked.

The young larvæ soon permanently attach themselves to the leaves, and in a short time become entirely hidden under their waxy exudations. As maturity proceeds the antennæ are lost and only traces of the legs are to be found (See illustration 3). The full-grown larva is some 1.05 mm. in length, and .77 mm. in breath. The rostrum is easily discernible with its three long protruding filaments. The vasiform orifice is also very distinct, showing well the operculum and lingula with its six spines (see illustration 8). The wax glands, of which there are 14, vary in size, all of them being plainly visible. The antennæ have completely disappeared.

(Illustration 1).

Ova of *Aleyrodes* attached to surface of leaf.

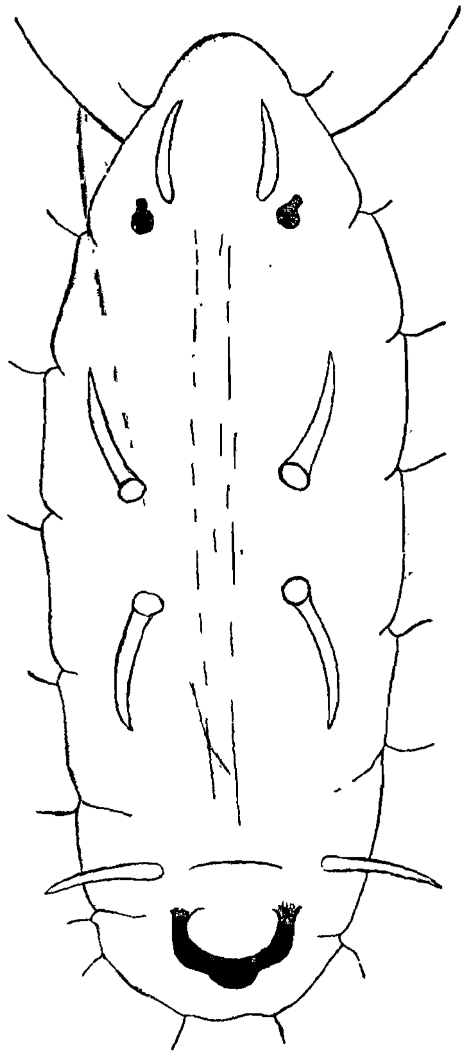




Ova after emergence of young larvae, seen from above and showing rupture.

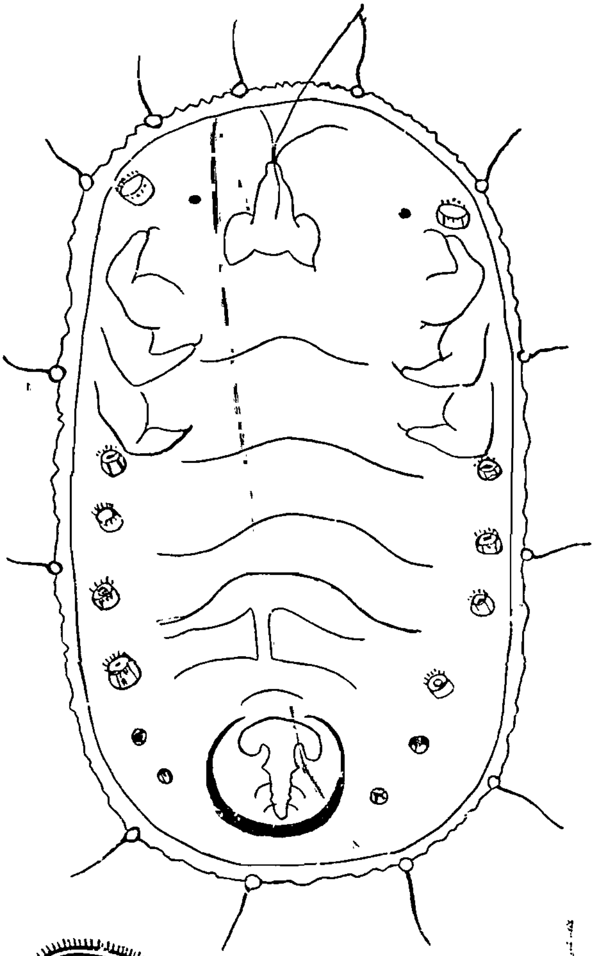
(Illustration 2).

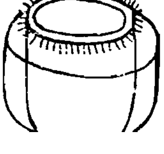
Earliest larval stage showing eight wax tubes.
Dorsal view, greatly enlarged.



(Illustration 3).

Full grown larva of ***Aleyrodes*** sp.
ventral view.

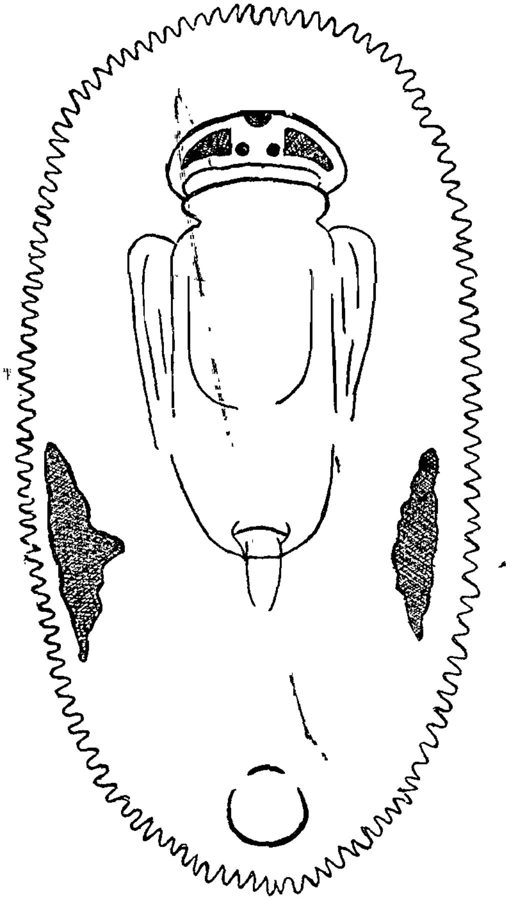




Enlarged drawing of wax gland.

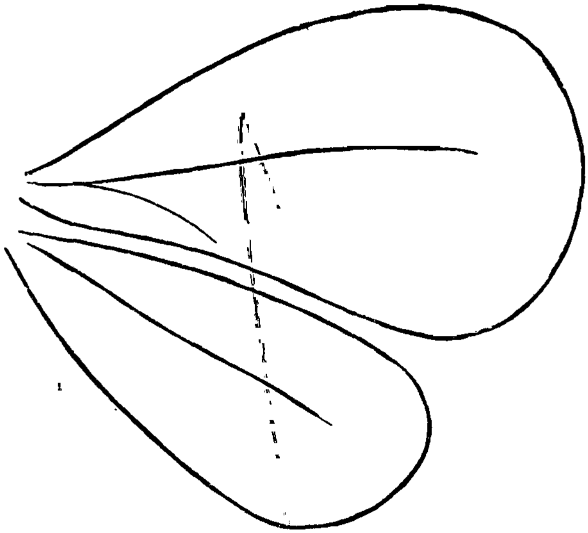
(*Illustration 4*).

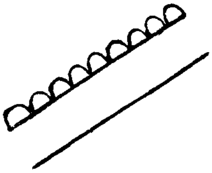
Pupa of *Aleyroaes* parasitised by Chalcid Fly.



(*Illustration 5*).

Anterior and Posterior wings
of *Aleyrodes.*



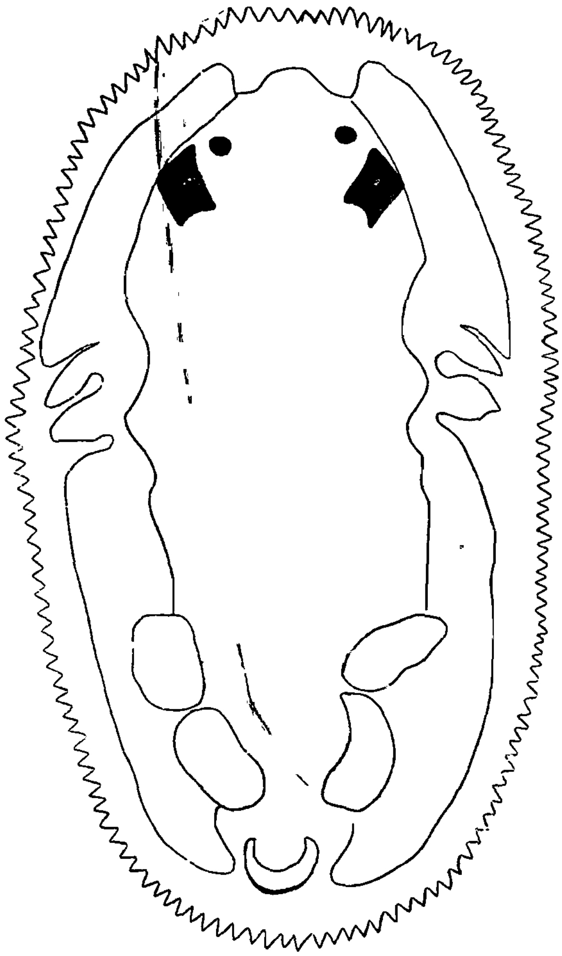


Edging of Anterior wing,
highly magnified.

(*Illustration 6*).

Aleyrodes Pupa.

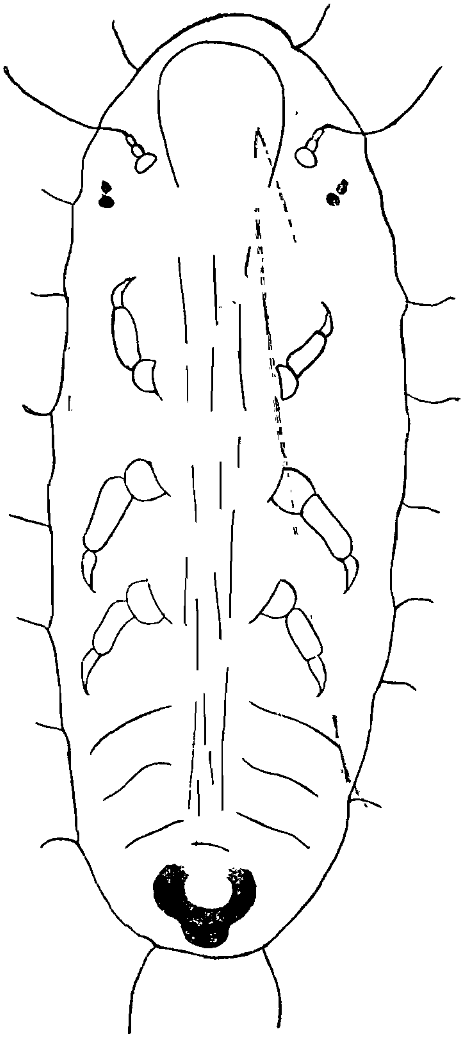
Mature insect almost fully developed.



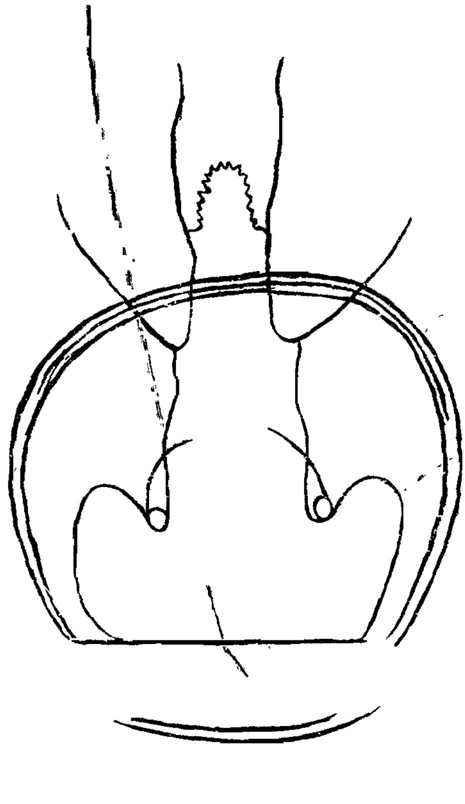
(Illustration 7)

Ventral View.

Larva of *Aleyrodes* earliest stage.

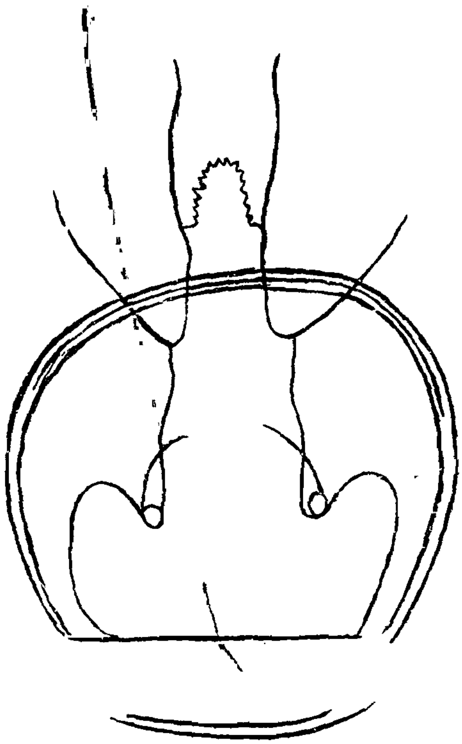


(*Illustration 8*).



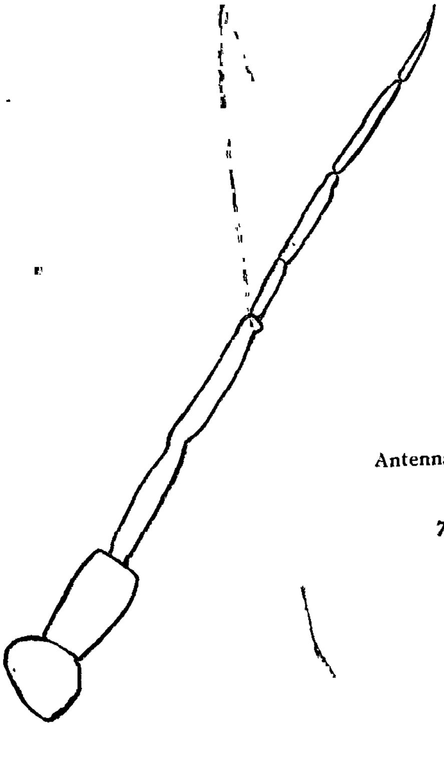
Enlarged drawing of lingula
and vasiform orifice, showing setae.

(*Illustration 8*).



Enlarged drawing of lingula
and vasiform orifice, showing setae.

(*Illustration 9*).



Antenna of
Adult *Aleyrodes.*
7 Jointed.

1st and 2nd Joints thickened

3rd Joint elongated

4th Short

5 }
6 } Equal length.

THE PUPA.

The pupa is oval and flattish with a distinct lateral fringe ; its length is .84 mm. and breadth .49 mm. (See illustration 6.) The remains of the vasiform orifice are still to be seen, also the ocelli and eyes of the developing adult. The empty pupa case is colourless.

PARASITES.

When large number of *Aleyrodidae* appear on a plant they are frequently parasitised by a species of Chalcid fly. These minute Hymenopterous insects may often be observed pupating within the pupæ of their hosts (see illustration 4).

THE ADULT.

In the adult *Aleyrodes* the female is .91 mm. in length, and the male .63 mm., with a wing expanse in both sexes of some 1.96 mm. The anterior wing is .85 mm. in length, and the posterior .77 mm. The adults are golden yellow in colour and their entire bodies are covered with a white waxy powder closely resembling the waxy " bloom " seen on some fruits. The vein in the anterior wing has a basal branch extending nearly to the margin, while the posterior wing has but a single vein. The delicate beading on the edges of the wings is more marked on the anterior wing. (See illustration 5).

The female may easily be distinguished from the males both by their greater numbers and size. The genital organs of the male consist of two forceps-like appendages on the last abdominal segment. The eyes are reddish and the antennae six jointed, the 1st joint being thickened, the second elongated, the third short, and fourth, fifth and sixth of equal length. (See illustration 9.)

This particular species has already been observed infesting species of *Anona* in Georgetown, also cassava plants on the East Coast, where it was doing considerable damage. Thus it will be seen that the species is widely distributed and not particular as to its food plant. Consequently it may at any time become a serious pest. Further observations are needed on these insects in the colony, and all persons interested in the cultivation of economic plants are invited to send specimens. Full instructions as to how and where to forward specimens will be found at the end of this number of the *Journal*.

G. E. BODKIN.

The Improvement of Local Rice.

EXPERIMENTS with local and imported kinds of rice have been continued during the year at the Experimental Fields, Botanic Gardens, with the following results :

Selected Varieties.	*Bags (120 lbs.) of Padi per acre.*
No. 6	32.1
No. 75	30.5
No. 3	27.1
Creole	22.6
Other Varieties.	
No. 43	29.4
No. 18	28.0
No. 17	26.8
Surinam Creole	26.5
No. 34	26.1
Surinam No. 2	24.0
Berbice Creole	22.1
No. 4	11.3

Taking the series of seven years (1905-1911 inclusive) during which these trials have lasted, the results read :—

Kinds of Rice.	*Bags (120 lbs.) of Padi per acre.*	*Creole taken as* 100.
Creole	33.9	100.0
No. 75	36.1	106.4
No. 6	37.1	109.4
No. 3	37.6	110.9

A number of variants giving good returns have now been grown, and these will now be used as parents for crossed varieties on Mendelian lines. The possibility of this has at last been proved by careful experiment, and it is hoped that good results on the improvement of local rice will result. The returns given by some of the best variants are remarkable. The original No. 75 gave 30.5 bags (120lbs.) of padi per acre ; of the variants of it obtained in 1909, Nos. 1, 4, 5, and 8 averaged about 40 bags per acre, while Nos. 6 and 7 gave 48 and 49 bags per acre, respectively. One 1909 variant of the original No. 6 (with 32.1 bags per acre) gave 41.9 bags ; a variant of creole original (which gave 22.6 bags) yielded 40, and a variant (No. 2) of Berbice creole (yielding 22.1 bags) gave 35.6 bags (of 120 lbs.) of padi per acre.

Grafting.

THE object of grafting is to obtain plants of special subjects which are not easily obtainable by other means; (*a*) plants which seed rarely, and those which are not easily amenable to propagation by cuttings, layers, etc. (*b*) plants which provide plenty of seeds but cannot be warranted to come true from seed. Many imported fruit trees require several years under the best circumstances before they bear fruit, and although they may reasonably be expected to produce their kind from seed, none is available for these years; those of known quality would be subjects for grafting as soon as they made sufficient growth to supply branches for the purpose, a few taken each year so as not to impoverish their strength.

Oranges and mangoes may be raised purely from seed but cannot be depended on to come true. Nutmegs will come true to seed, but there is always the uncertainty of the "sex"; and as a large number of the seedlings prove to be "males," a very much larger number than is actually needed must be planted, so that when the plants prove their sex most of the males have to be cut out, only a few of this sex being required to several "females." This must of necessity cause considerable loss of time for filling vacancies unless there be "females" elsewhere available to transplant; this, of course, entailing extra labour and expense.

It is useless to expend time and labour in grafting plants which can be easily propagated true to their type by seed, cuttings or layers. Of course any fairly soft-wooded plants can be used for lessons in the art of grafting, so as to accustom a pupil to the use of the knife, proper fixing of the stock and scion, and covering the union to exclude the air and moisture and to prevent any possible drying. When the pupil has become efficient in these things he may be put to manipulate plants which require grafting as a special means.

SELECTED METHODS.

Grafting in its many forms as practised in cool climates, *i.e.*, with a cut-off scion, is not applicable here; evaporation is so rapid that the scion dries up before there is time for a union to take place. The same applies to budding. I am aware that both these are recommended in the West Indian Islands as a means of propagation, and in some places are said to have been successful; but although budding has been tried here and at Onderneeming, of the many dozens of buds which have been placed, only two have succeeded;

one in 1909, and one this year : so that although it may be said to be possible the percentage of success is not sufficient to warrant a continuance of this form of propagation.

The forms of grafting used here with success,—and if properly performed should produce no failures—are the "approach" and "inarch." In these both the stock and scion are growing plants, either two young plants of similar age or size in pot, basket, or tub ; or a large tree with low branches, the branches to be used as scions, to which young plants in pots, baskets, or tubs are brought as stocks. It is frequently necessary to raise a platform beneath the tree from which the scions are to be used, on which the stocks are placed to bring them to the level of the scions, as the place of union must be arranged so that there is no strain on either stock or scion, but both must be placed so that they will meet comfortably.

THE RESULTS OF EXPERIENCE.

The method which I have followed and which I have persistently taught both in the gardens and to outsiders is the "approach" and the "inarch" combined. The "approach" is a very simple form of grafting and is a very successful one if carefully performed—though I do not consider it safe for strong growing trees as it is likely to twist off if the young trees are much exposed to strong breezes. Care is necessary far more in the fixing and tying than in the cutting and fitting,—though these must of necessity be neatly done, for each surface is smooth and will easily slip out of place. Even a strong breeze may have the effect of misplacing the union—which is performed by taking a long slice of bark and wood from both stock and scion and fixing the two cut surfaces together.

The "inarch" is a very safe method and far less likely to slip at the union. A long cut is made downwards into the stock, running obliquely from bark to centre ; on the scion a thin slice of bark and wood is taken off the side which will face the stock, of the same length as the cut in the stock, and a tongue is made by cutting upwards in the scion for the same length, cutting from outside to centre ; this tongue is then slipped carefully into the stock, making it fit closely. and bringing the barks together. If the scion and the stock are of the same size the barks will fit together on both sides ; though this is not actually necessary the union will be all the better if the barks on both sides meet.

A STRONG JOIN.

My own method is a combination of the two which makes a much firme union that can possibly be with either separately ; no amount of shaking by the wind after the union has taken place can affect it.

It is thus operated :—Stock and scion are placed in position and both marked so that when cut they will meet exactly. The stock is prepared first, all irregularities are taken off so that the surface is quite even ; a long thin slice of bark and wood is cut from that part to which the scion will be attached, and a long deep cut is made downwards obliquely from the outside to the centre, commencing an inch or more below where the top of the sliced portion begins ; this given a loose tie to prevent breaking whilst the scion is being prepared. The scion is then taken in hand and the same operation performed on it, both as to slicing and tonguing, the cut being made upwards, the very opposite to that of the stock. The tongue made in the scion is then slipped into the cut of the stock and made to fit closely all along the cut surfaces ; not only will the tongue fit into the cut stock but the sliced surfaces above and below will also meet for their whole length, so giving the union of the approach and that of the tongue of the inarch. Ties must be made both top and bottom to keep the parts close together and then the whole length of the union is firmly bound with matting or soft string. The whole union must then be covered with some material which will keep out the air to prevent drying, and also exclude excessive moisture.

BINDING MATERIAL.

For the first binding, matting is the best material, being thin and flat and more likely to yield to the pressure of the swelling tissues than string, however soft. The matting is obtained from various species of *Hibiscus*, notably *H. tricuspis*, *H. elatus* (Cuba bast) of which there is a large quantity growing on the coast lands ; *H. tiliaceous*, and *Thespesia populnea*. Strong branches of these are cut, cleared of all leaves and small branches, made into small bundles and buried in the mud of the trenches for a few weeks ; they are then lifted and washed, the bark stripped off and dried in the sun. This gives excellent material for tying purposes, not only for grafting, when it is used flat, but also for the general tying of plants, used rolled like string, either fine or coarse as the various plants need.

In the old days and till a few years since, the covering of the grafts afte the unions were secure was done by enveloping the place operated on with a small elliptical ball of prepared clay and cowdung mixed with chopped hair,—this last to prevent the ball cracking,—well mixed together into a plastic mass. After the union was completely covered a piece of sacking was tied round to help keep

the balls moist by retaining the water after each day's watering—which must be done during dry w ather, otherwise the balls will cake like cement. Now-a-days waxed tape takes the place of balls, making the grafting process a much neater-looking affair. The tape should be about $\frac{3}{4}$ inch wide, dipped in a mixture of rosin and bees'-wax—two parts bees'-wax carefully melted with one of rosin. Dip the tape into the melted mixture and allow all superfluous matter to drain off: when cool the strips are ready for use. Another mixture used is bees'-wax with a sufficient quantity of kerosene oil to render it soft and pliable: the mixing being aided by the cautious application of heat.

ALLOWANCE FOR SWELLING.

The tape should be wound round the union commencing at the bottom, each ring overlapping the previous one, so that no moisture can enter the cuts, the whole surface of the cuts from base to top being completely covered. There is no need to tie the tape as it will stick closely if firmly pressed. It must be remembered that when the parts begin to unite a certain amount of swelling takes place and it is necessary for ultimate success that the tape or the fastenings of the old method should be loosened to allow the parts to swell, otherwise there will be constriction at the union. When the grafts have been put on a month, the bandages should all be taken off and the uniting parts rebound; this gives freedom to them and allows the necessary swelling to take place. At the end of the second month the same loosening and re-tying should be done: a fair union should by this time have been made though not sufficient to warrant a severance from the parent plant. A notch may be and should now be made at the base of the scion, cutting half through it, which will partly "wean the scion" and make it draw more sustenance from the stock. At the end of the third month complete severance may be made with certainty; the base of the scion and the top of the stock should be neatly pared down so as to make the union even with the stock at both ends. Cover the pared ends with a little tar to prevent any chance of disease germs entering the cut surfaces, taking care that the tar does not un as it will burn the tender bark. It must be remembered that clean cut wounds always heal much quicker than jagged wounds, so that in all the operations the knives used should be sharp and clean.

INCIDENTS IN PRACTICE.

To give an idea of the necessity of loosening the bands periodically I will state what happened in our Nursery on one special occasion

as a result of neglecting this. A large batch of mango grafts had been put on and the plants severed at the end of the necessary three months. They presented a very peculiar appearance. The unions were exactly like Ipecacuanha roots, with deep annulations for a length of 3—4 inches. These rings had been formed by using hard material (tarred rope) instead of the usual matting for the bandages, which had been bound round the unions with spaces between the windings, and left for the whole three months without examination. Large swellings took place between the rings of the rope, which became tightly wedged between them. Anything [illegible] unsightly could not well be imagined, and it took months before these had grown into a form decent enough to allow of the plants being distributed.

Another unfortunate incident happened 4 to 5 years ago. Two hundred grafts were needed to supply orders, and these we were in a position to execute without much pressure. Three of the men in the Nursery were good grafters and they received order to put on this number of grafts from specified trees in the Nursery. I was going on leave and offered three prizes for the best grafting done during my absence, stipulating for nine-tenths of each man's work for success. This I considered a fair percentage as the men had previously done good work. If carefully done no failures were to be expected. Although they thoroughly understood the work they were given a special lesson, the whole process being carefully gone through as if they had never seen it done before. I expected certainly to distribute the prizes on my return, but was doomed to disappointment; not only had I no prizes to pay but the stock of grafts so urgently needed was not forthcoming; none of the men had obtained 50% of successes, and in spite of my care before going on leave nearly all the work had been badly done and in many instances the grafts had been put in upside down.

UPSIDE DOWN.

It will probably seem strange to many that it is possible for such work to be performed upside down, but I will mention a case in which this was done most disastrously with a batch of twelve grafts put on in town—the stocks were all grafted to the scions on a large tree instead of the scions to the stocks! The work had been splendidly executed and when the plants were severed from the tree they were in excellent condition, but in two or three days they were all dead. This, of course, was a bitter disappointment as three months had been already wasted and it required another three months to obtain a fresh stock. In this case the whole work had

been done consistently right through : as with the first plant so with the last. No idea occurred to the operator that anything was wrong till the plants died ; but with those in the Nursery it was a case of carelessness, because some were grafted in one direction and some in the other from the same tree.

HISTORICAL.

When I arrived in the colony in 1878 grafting was practically unknown here and I believe I was the first to practise it. The first operation took place at Government House for His Excellency Sir C. Kortright in 1879. Four of five grafts put on from the Ceylon mango on the lawn succeeded, the failure of the fifth plant being due to an unsteady stage ; this is the only graft that I lost of the large number I grafted in the first few years of my residence here. The next lot was done at Pln. Ruimveldt, for the Gardens, from a small tree of "Purple Bombay," and later on for Messrs. Sandbach, Parker & Co., a large number from the same tree. After this four kinds were grafted at Pln. Providence, East Bank, Demerara River, for the Gardens. Stocks were taken in each case growing in tubs from the Gardens with all necessary materials, and when ready were brought to the Gardens and planted ; these when sufficiently grown were grafted from and a small stock of plants raised. At the same time the more intelligent of the Nursery men were taught so that the process should not depend altogether on my efforts. In those days there were absolutely no failures and the same may be said of the time when Mr. Ward was in charge of the Nursery, excepting in the case of the dozen plants previously mentioned.

The late Mr. Jenman was very keen on grafting. When the trees began to fruit every seed was saved and kept religiously named. Large numbers were distributed as seedlings, and large numbers were grafted from the named seedlings on stocks of the strong-growing common Mango ; that mangoes grown from seed cannot be depended on to come true, was decisively proved by what follows.

ORIGIN OF THE "ROWLAND" MANGO.

The disproof came about in this way :—About a dozen plants grafted from seedlings of good and well-known kinds were sent to Dr. Rowland at the Public Hospital, Berbice. These plants grew well, made fine trees and fruited ; the Doctor asked me to go and see them and he pointed out the various kinds by name. Alas !

not one of them was true. I requested the doctor to send fruits of each so that Mr. Jenman might see them, as I could see plainly that this was a case fully proved of the inability of the mangoes, placed as ours were (many kinds in close proximity) to come true from seed. The fruits were sent, and the result was that no more seedlings were grafted from. Very many other persons must have had a similar disappointment both in seedlings purchased and grafted plants taken from seedlings. In this connection however a good new variety was raised; one of Dr. Rowland's plants turned out to be different to any yet known, evidently a seedling from one of the best of the Ceylon mangoes. This I named "Rowland" when it was exhibited at the Berbice Exhibition. Many grafts have been distributed so that in a few years there should be plenty of this delicious kind for consumption.

NECESSARY CONDITIONS FOR GRAFTING.

Grafting can be successful only on plants allied to each other, such as varities of the same species; of the same genus; genera of the same natural order. No two distinct orders of plants will unite, there must be affinity. For instance, oranges will not unite with mangoes and *vice versa*. All the different members of the Citrus family will inter-graft; any orange seedlings, Seville orange, or lemon stocks may be used on which to graft the best varieties of Sweet Orange, Tangierines, etc. Seville orange stocks are much the best, as they are strong growing. Lemon stocks are frequently used on account of their robust growth, but experience teaches that plants raised on these stocks are short-lived, and cannot stand the extremes of our climate. One special reason for grafting is that grafted plants make much smaller trees than seedlings, and produce fruits much earlier. Mangoes have been seen flowering the same season in which they were grafted: this of course is the result of having grafted a scion which in any case would have flowered on its parent. In such a case the flowering should not be permitted as it must necessarily reduce the strength of the young plant and probably retard its future success.

TIMES AND SEASONS.

Grafting may be done at any time of the year when there is "rising sap." The wet season is undoubtedly the best time, as then the sap is in full flow and there is less anxiety as to keeping the grafts cool and moist. In the dry season the sap must necessarily be sluggish and there is always the fear that the watering of the stocks

may be neglected; and if these are allowed to suffer for want of water union cannot be effected. Any tree to be grafted from should be examined before any attempt at grafting is made; if the tree is in full vigour grafting may be done with hope of success no matter what the season. Young sappy shoots of the same year should not be used, but those of the previous growth which have partially hardened, and have all the foliage in good condition, with no sign of resting.

THE IMPORTANCE OF THE "CAMBIUM."

Monocotyledons as a rule cannot be grafted as they have no cambium layer to affect a union; yet experiments have been tried with such plants as Dracaenas and are said to have been successful; but these monocotyledons are remarkable in having a special cambium layer. Still, except for proving the fact that union is possible, nothing is to be gained by it, as such plants are easily propagated by cuttings.

JOHN F. WABY.

The Importance of Exact Records.

Frequently, when judging at Agricultural Shows, we are asked the question—do you think these are better than those shown last time? As a rule we can only give a pious opinion, for we have not time for more. What is wanted is that at every Show, the sizes and weights of the produce should be recorded, and it will then be possible to say in a few years whether improvement is going on or not; at present one must simply depend on the judgment and opinions of regular attendants at a show. It is, of course, true that size and weight are not everything in a fruit or a vegetable, but they are something, so long as one sticks to a given variety.

The importance of exact records is but slowly coming to be realised, but, with the advance of science and the adoption of scientific methods in other subjects, is making progress. If seeds are distributed, for instance, little good is done unless exact records are kept of place sown, date sown, proportion of germination, growth yield, cost, and other things. If such records are obtained from many places, a guide can be given as to the likely result in any place. By means of the school gardens we are obtaining such records for many kinds of plants, and the more the better.

If a new manure is tried it should be carefully compared with the old on measured blocks of equal size, for equal length of time, and so on. Until exact recording comes in, agricultural progress will be slow and devious. The methods of science must be used.

—Tropical Agriculturist: May, 1911. (Ceylon).

Local Agricultural Shows.

WEST BANK.

THE West Bank Farmers' Association is again to be congratulated on having produced an apparent success on the occasion of its eighth annual agricultural show held on the 9th August at La Grange.

By an apparent success I mean that circumstances have transpired to make this questionable. It appears in several items that more than one lot of the same kind in different sections have been exhibited by the same person to make a good show for the credit of the West Bank, so that it has been remarked that it is developing into "a one man's show." It undoubtedly adds to the appearance of the show to have a good quantity of good articles on exhibit, but it gives in some cases little chance to other competitors. It does not always turn out that these quantities are of use to the exhibitor as regard securing prizes, still it did so in one special case this year, *i.e.*, the exhibit of cacao-beans, where the one exhibitor secured the three prizes offered. Undoubtedly these three baskets of beans all came from the same lot of prepared beans, and the chance of such occurrences adds to the difficulty of the judges in awarding prizes.

In the creole coffee, too, more than one basket belonged to one individual, and two prizes were obtained by him. In the sweet oranges a good quantity of the exhibits belonged to one person though no prize was given for them. In the shaddocks, two prizes were obtained by the same person, and probably other items as well. The two prizes for castor oil both went to a person resident at Nabaclis. Last year in the sweet orange section 20 of the 52 lots exhibited belonged to the same person. A glance at the list of entries for both years would tell its own tale and it would be seen by this how far this kind of thing has been practised.

Again I do not think it right—and I am not alone in this opinion—that other districts should be allowed to compete in any district Show, for it gives no chance whatever of finding out what each district alone is able to do. Last year the East Coast furnished about one-third of the whole exhibits of the West Bank show and obtained a large share of the prizes, so that the praise which was bestowed on the West Bank Association was not all deserved. This year, also,

exhibits came from the East Coast, to what extent I cannot say; still 24 prizes were awarded them according to the *Daily Chronicle's* account of the prize list.

The judging this year took a much more practical turn, in the fruits especially. Very few of the exhibits which should be cut for judging escaped the knife, and tasting was the order of the day, so that it may be confidently stated that the best fruits came in for the prizes and they were not judged for size alone as was the case last year. In the economics, too, the same care in judging was noticeable.

REMARKABLE RUBBER EXHIBIT.

There was but one exhibit of rubber and this was excellent. Here we had Para rubber tree exhibits in every stage—branches with fruit; a good quantity of seeds; latex just collected, and with the coagulum beautifully clean and white in a bucket of water to which acetic acid had been added; a large number of flat cakes of rubber well prepared, and several lots of scrap. My contention of last year with regard to the foliage and seeds was well sustained, for those exhibited this year were the real thing and very different to those of last year. Kola-nuts were also exhibited in branch and fruit.

The arrangements were exactly the same as those of last year; *i.e.*, under the house occupied by Mr. Thos. Earle, the President of the Assocation. The fruits occupied tables on the south side with an "overflow" on a small separate stand near. They were huddled together, sufficient room not having been allowed in the first instance, so that when the later arrivals came these had to be [illegible] basket on basket; there was plenty of empty space which could have been used for this.

The exhibits of the Board of Agriculture were staged in the usual pyramidal stand at the entrance of the show; those of the model and school gardens were in the separate stand as usual on the south side, with the rubber exhibit from Noitgedacht on a table by itself.

The quality of the exhibits may be said to have been fairly good as a rule. The weak points were fresh garden produce and some of the economics.

BUXTON AND FRIENDSHIP.

This show, held on August 29th, was almost entirely an East Coast Show as far as the general exhibits were concerned, few

articles coming from outside the district. Only 5 prizes went over the river, and 12 to Georgetown.

The school and model gardens prizes went principally out of the district; 13 of the former and 23 of the latter.

As usual the show was held in the Wesleyan schoolroom at Friendship, a place eminently suited for the purpose, but scarcely large enough to contain the exhibits without considerable crowding. This has generally been the case, but there seems to be too little initiative amongst the Committee to improve this state of things. The arrangement is always the same, and although the entry-list must have shown the necessity of enlarging the space necessary for some of the exhibits, particularly the vegetables, these were kept religiously to the allotted space, things were heaped on the top of others, and the section was enlarged only by placing school benches in front of the tables. This made it not only difficult for the judges to get near the exhibits behind, but also prevented the visitors from seeing to advantage and lessened also the circulating space, which at the best was much cramped for the large numbers present. Considerable space is always taken up at this show for fancy articles and needle-work. Three large tables were set aside in the centre of the room for these, but there were comparatively few articles exhibited, and one of these tables could conveniently have been taken over for the "overflow" from another section. Again, there was considerable loss of space on the economic side, which by a better arrangement could have been used for the continuance in sequence of the vegetables without in the least interfering with the economics.

There were tables of a convenient width all round the schoolroom; two broad two-sided tables the whole length of the room on the east and west centre; three large tables in the centre for fancy work; and the Board of Agriculture stand in the centre immediately in front of the entrance.

As a whole the show may be said to have been fairly good, but there was a decided weakness in the Liberian coffee, cacao and rice in economics; bitter cassava, bread fruit and general garden products—except tomatoes and ochroes—in the vegetables; Jamaica and red bananas, sapodillas, the various apples, sweet and Seville oranges and lemons in the fruits.

—J. F. WABY.

Mr. Quelch's Work on Insect Pests.

THE ultimate aim of the study of destructive insects is the discovery of some really feasible method whereby their increase and destructiveness may be checked and crops preserved from their attacks. In such a quest, not only must the habits and characteristics of each individual pest be considered but it is of equal importance to take into account the conditions under which the crop is grown and the facilities there re for adopting any method of repression. In attacking the problem of *Castnia licus* and other insect pests on the sugar cane in British Guiana, Mr. Quelch has worked on these lines, and it is only by the methods of control embodied in his three very able reports that these many pests can ever successfully be combated. In the second report, dated April, 1911, he gives a table of the number of larvæ and moths disposed of on the various estates during varying periods, and a short inspection of these figures will show how serious a menace these pests have already become to the sugar industry in the colony. It is unfortunate that with the exception of Pln. Enmore the figures relate only to the first attempts at any definite methods of control, and consequently no satisfactory basis for comparison exists. The lack of labour at all times, and more especially during the long grinding season, which is the most favourable opportunity for attack in newly cleared areas, seriously handicaps complete remedial measures being taken. Moths secured in the newly cleared areas reduce very considerably the chances of a heavy development in standing canes in the neighbourhood. The main hope, Mr. Quelch states, "lies in the systematic application of artificial remedial measures for the control of these pests, and if they are properly carried out there should be no great difficulty in reducing this pest to such a degree as to render it but an irregular feature of the cultivation though one that would require continual watchfulness." In his last report, dated June, 1911, he again draws attention to these words, and this after further close investigation and wider spread experiences.

THE ENCOURAGEMENT OF NATURAL CHECKS.

Mr. Quelch also emphasises the encouragement of active natural agencies such as birds, parasitic insects, etc., and to this end he advises that there should be provided for the birds suitable bush and tree belts for their shelter, protection and nesting. The erection of suitable perches in the fields, though to some extent affording better opportunities for the hawks to terrorise over such forms of bird

life as the Old Witch, should not be disregarded, for as often as not they are tenanted by most useful hawks capable of destroying large numbers of moths.

THE BURNING QUESTION.

The practice of burning the fields Mr. Quelch very rightly condemns as being totally against the permanent interests of proprietors. The arguments in favour of the practice are entirely economic ones. If burning is not carried out a greater expenditure is required in burying the trash, trashing the canes, and in cutting the canes. The arguments against burning, although appearing to the untrained mind as somewhat trivial and engendering considerable expenditure, include some of the most fundamental laws which, for the satisfactory growth and general well being of the plant, must rigidly be observed. By the destruction of humus the fertility of the soil is reduced and the alkalinity affected. Also by keeping the soil open, moisture is both absorbed and retained (thus guarding against adverse conditions of excess and deficiency in these respects) and a very necessary state of soil aeration is brought about.

Apart from these considerations, various natural agencies which control the pests of the cane are either destroyed by burning or driven away, while the majority of the pests themselves are secure from fire. Numbers of tops used as plants are deteriorated and their vitality reduced. Continued operations of this sort will weaken the most perfect seedling ever produced by scientific research. Other ill effects consist in the stools becoming eventually infested by weevil borers; and the juice of the standing canes themselves will deteriorate if left too long after burning.

The economic considerations connected with this practice are undoubtedly, of weight but surely it is better to secure the chances of a continued good yield and a comparative immunity from insect attack than to indulge in an operation which, although appearing to be economical, is entirely at variance with the primary laws of cultivation.

Small areas cropped between other standing canes Mr. Quelch deprecates as spreading infection and disorganising the work of the gangs. It is in these instances that flooding may be utilised to minimise the labour required. Cropping in the largest blocks possible the more frequent it may be during the year especially in rotation, offers the most favourable opportunities for the control of insect attack at the same time centralising the labour.

Diatræa SPP.

Mr. Quelch has also demonstrated the occurrence in the fields of three distinct species of the small moth-borer, at one time known collectively as *Diatræa sacharalis.* These he now identifies as *D. canella, D. sacharalis* and *D. lineolata,* giving also a full description of the various life stages, making their identification an easy matter. The early cutting out of these small pests from the cane is an absolute necessity, for their breeding capacity is enormous and soon brings about a heavy infestation. For their further control Mr. Quelch advocates the use of trap lights especially on warm dark nights. The trays should be about 2 to 3 feet in diameter as they can thus be easily handled when it is necessary to make an inspection of their contents. They should contain a mixture of paraffin and water, and in use should be placed close to the lamp.

Two egg parasites of the small moth-borer have been discovered by him, and Mr. Quelch considers them to be identical with two such forms described from Java—*Ceraphron beneficiens* and *Chaetosticha nana.* Apparently the former species is the larger and parasitises the eggs singly, one in each while the latter is smaller and often occurs 2 or even 3 in one egg. Their method of fertilisation is also interesting. The previously freed males keep close to the egg cluster taking note when any female begins to break through, and fertilisation takes place immediately upon emergence after some struggle among the males. Thus the females are at once prepared for the deposition of fertile eggs.

HINTS.

The collections of the egg clusters of the small moth-borers are better taken from the younger canes for here large numbers are to be secured and being taken out at an early growth of the cane prevent further infestation. Weevil borers, hardbacks, mealy bugs and wood-ants all find a place in these reports. Also a word of warning in regard to trashing the canes—wounding the tissue by tearing off the gre n leaves not only renders the plant liable to the attacks of several kinds of insect and fungi, but considerably retards the growth of the cane.

In conclusion we must sympathize with Mr. Quelch that all too soon he was obliged to bring his work to a close, but at the same time we heartily congratulate him on his very masterful treatment of a most difficult problem.

G. E. B.

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The Causes of Salinity in Soils.

In all countries having a high summer temperature combined with a deficient rainfall, there occur tracts of land which contain such a high proportion of soluble salts that the growth of vegetation on them is hindered or even inhibited.

Under these climatic conditions, the texture of a soil is an important factor in determining the appearance of saline substances in it. In loose open soils, a considerable amount of percolation may occur with a small rainfall and thus remove the harmful salts. On the other hand in close heavy soils and especially in these having imperfect drainage, little or no percolation occurs and in consequence the harmful salts are not removed from the soil, but remain in solution in the soil water. During the dry season this water evaporates from the surface, where the saline substances accumulate as years go on. As these salts accumulate the natural vegetation becomes less and less until it is finally killed and the soil becomes sterile. Again the presence of an impervious layer in subsoil prevents free drainage to the land and in the manner described produces a tendency for the soil to become saline. In fact under many of the saline tracts in Madras such an impervious layer exists.

The substances which give rise to this harmful condition are numerous, but usually there are found in the soil the carbonate, sulphate and chloride of soda. These salts are produced by the decomposition of the rock minerals in the soil, and the type of saline soil produced depends upon the predominence of one or the other. Thus carbonate of soda gives rise to what is termed " black alkali, " a condition which is most harmful to plant life. Sulphate and chloride of soda give rise to " white alkali, " a condition which although exceedingly detrimental to vegetation is however less so than the black alkali.

TRANSPORTED SALTS.

It does not follow that because a tract of land is saline that this is due to the decomposition of the minerals in that soil. In many cases the harmful salts have been transported some distance from other areas, for in well drained lands the soil solution percolates to a lower level and the harmful salts are thus removed and finally are incorporated with the waters of the ocean through the agency of springs, streams and rivers. Occasionally however, this drainage water finds its way into a tract of soil from which there is no natural outlet and accumulates there causing that area to become saline.

In all saline land in addition to these harmful salts, there are present certain other substances which form the food of plants and in fact for this reason, alkaline lands are generally exceedingly fertile when once the obnoxious salts are removed from them. Consequently a considerable amount of attention is being paid to their reclamation in many parts of the world.

From the foregoing it is evident that the appearance of salinity is largely due to deficiencies in drainage and the most successful methods adopted for the reclamation of saline lands are those which aim at improving the drainage of such land. Many methods have been suggested and employed for the alleviation of the condition of saline lands and of these the most successful will be described.

METHODS OF RECLAMATION.

A method often employed in previous years consists essentially in covering the saline land with a layer of fertile soil. This is brought about either by flooding the land with muddy water and allowing the latter to drain off, leaving the suspended matter behind or by carting soil on to the area so as to cover it to a moderate depth. No doubt with a certain expenditure it is possible to obtain crops by this method, but the causes which produced the salinity in the first instance still remain in operation and sooner or later the harmful salts are concentrated in the new layer of soil and the crops suffer. As an efficient and permanent cure this method cannot be recommended.

A second method consists in dressing the land with large quantities of gypsum (sulphate of lime) and this substance by re-acting with the soda salts give rise to other substances of a less poisonous character and permits crops to be produced. At the same time it affects the texture of the soil so as to improve the drainage. The application of this substance has undoubtedly been effective under certain conditions, but it is scarce in India and therefore would probably prove too expensive for use by the ordinary cultivator.

Probably the most effective way of dealing with these soils is to well underdrain the land and then subject them to heavy irrigation with good water. The cost of underdraining is, however, comparatively high and on that account would not commend itself to the ryot.

OPEN DRAINS.

A cheaper variation of this method is to divide the saline area into comparatively large sections by means of deep open drains, the earth so excavated being utilized for the formation of bunds (dams) around the sections. Each section is then flooded with water to a

moderate depth and the water then percolates slowly through the soil to the drains carrying with it the injurious salts. Sometimes one flooding will clear the land so as to enable crops to be grown, but more often it is necessary to repeat the operation several times whenever sufficient water is available. Of course such a method as this is inapplicable wherever water is scarce as in many of the dry lands of this Presidency, but it can be carried out in many of the irrigated areas and often where an efficient well supply is at hand.

The ryots of the Kistna Delta reclaim saline land by puddling in large quantities of paddy straw and then flooding with water. The straw in itself assists drainage and even after decomposition has taken place the humus produced has the same effect.

—W. H. Harrison in "Madras Agricultural Calendar," 1911-12.

Sources of Atmospheric Ammonia.

Many terrestrial sources of ammonia can be specified; the smoke arising from coal fires shows its effect in the increased amount of ammonia in the rain of towns, and all decaying animal and vegetable matter must be contributing some ammonia to the air. Volcanic emanations afford another terrestrial source of ammonia, though the numbers of active volcanoes in relation to the total amount of the atmosphere would seem to render such contributions inappreciable.

Atmospheric Ammonia and the Soil.

The question of whether the soil does gain any ammonia from the atmosphere by direct absorption is one of considerable importance in any attempts to construct a balance sheet for the nitrogen received by, and removed from, an experimental plot over any length of time, and investigations were initiated with the view of obtaining further light upon the problem. The main object of the investigation has now been attained and it can be concluded with some confidence that whether the soil normally gives off or absorbs ammonia, the total amount of absorption is very small. Even assuming the soil is as effective an absorbing agent as the sulphuric acid in our experiments the maximum absorption per annum amounts to less than a pound per acre, a quantity that would be negligible in any estimates of the gains and losses of mitrogen on a given piece of land under any method of treatment.

—A. D. Hall, F.R.S., and Dr. N. H. J. Millar in "The Journal of Agricultural Science" (Cambridge), May, 1911.

The Rubber Exhibition of 1911.

SUCCESS OF BRITISH GUIANA EXHIBITORS.

British Guiana has every reason to remember with satisfaction the International Rubber and Allied Trades Exhibition held in the Agricultural Hall, London, during June and July, 1911; for two silver cups were won by exhibits from the colony and the remarks made by the judges concerning the prize-winning samples were most gratifying.

The West India Committee offered a silver cup for the best sample of balata exhibited from a West Indian colony, and another cup for the best prepared sample of plantation rubber exhibited on a West Indian Court at the Rubber Exhibition. The former cup was awarded to the Consolidated Rubber & Balata Co., Ltd., for some really fine sheets of balata, and the latter was won by Mr. W. Hodgson of Pln. Noitgedacht, Rio Demerara, for an exhibit of well-prepared Para biscuits. The Consolidated had it practically all their own way in reference to the balata cup, but the competition for the rubber cup was keen—some excellent samples of sheet Castilloa from Tobago prepared by Mr. H. S. Smith's centrifugal machine running Mr. Hodgson's samples very close. The judges were Mr. Kelway Bamber (Ceylon), Mr. Porter (Mexico), and Mr. Marshal (representing the West India Committee.)

British Guiana is to be congratulated upon securing this rubber award, and it is hoped that it will help to give further stimulus to the infant rubber industry. It is at least satisfactory to know that British Guiana Para biscuits are considered to be of high quality; in fact it is stated that Mr. Bamber was of the opinion that the biscuits exhibited by Mr. Hodgson were fully equal to the best biscuits that are prepared in Ceylon.

Two other cups were offered for competition amongst the West Indian Courts. One was presented by Messrs. Booker Bros., McConnell & Co. for the best sample of rubber prepared by a Botanical or Agricultural Department. This was awarded to the Agricultural Department of Trinidad. The second was presented by Mr. W. Middleton Campbell for the best comprehensive exhibit forwarded by a Permanent Exhibitions Committee. This cup went to the Permanent Exhibitions Committee of Trinidad and Tobago for the fine exhibit shown by them.

At a special meeting of the Royal Agricultural and Commercial Society held on September 22nd, the acting Governor (the Hon. C. T. Cox, C.M.G.), presented the cups to the winners.

No reference to the Rubber Exhibition of 1911 would be complete without acknowledgement of the invaluable work done thereat by Mr. F. A. Stockdale, Hon. Secretary of the Permanent Exhibition Committee, who represented British Guiana. He spared himself no time, trouble or labour to advance the interests of the colony, and his painstaking work has been warmly acknowledged on all hands and not least by the Legislature. In the next number of the Journal we hope to publish a personal impression and critique of the Exhibition by Mr. Stockdale himself.

Mind and Method in the Rubber Industry

Reverting to plantation rubber, one is almost tempted to inquire if there is really any necessity for a multiplicity of forms or if any particular form possesses distinctly specific advantages. Here, I fancy, the manufacturer might have something to say. The diamond-panelled sheeting is advocated, on the assumption that when packed a free circulation of air is permitted, but on this count is it any better than crepe, whose surface configuration permits the same thing ? In reality shape or form does not matter at all provided the rubber can be conveniently mixed up in the masticating machine, and possibly all forms of sheet or biscuit or worm are preferable to fairly substantial blocks although blocks may be convenient for transport.

No one who has seriously gone through the exhibition can believe otherwise than that rubber from the Mid-East will become increasingly an important factor in the world's consumption, not because of the increase of the acreage under rubber, not because of the good quality of the rubber, but by virtue of the earnestness displayed on the part both of the various Governments and of the planters.

True the commercial aspect is an influencing factor, but beyond this there rings a note of deeper significance in the desire to arrive at the fullest understanding of all pertaining to the product united with a utilisation of methods calculated to turn out a standard article.

—"The Financier" on the Rubber Exhibition, 1911.

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—"The Financier" on the Rubber Exhibition, 1911.

Sapium Jenmani at Bonasika.

RESULTS OF EXPERIMENTAL TAPPINGS.

It is now possible to publish some of the results obtained from the long series of careful experiments conducted at the Bonasika reserve on wild trees of *Sapium Jenmani.* The tappings were commenced in 1908, were carried on for two years, and have yielded results of a disappointing nature, perhaps, to the enthusiasts, but valuable from a scientific point of view . It must be pointed out and emphasized that the results apply only to old trees of *Sapium Jenmani* growing in conditions such as obtain on river banks as at Bonasika; they do not justify any conclusion being drawn as to the behaviour of young trees in plantations on higher and drained lands. The Director of Science and Agriculture, who submitted the report at the October meeting of the Board of Agriculture, was careful to draw attention to this point.

At Bonasika, then, the following points were noted : The trees yielded latex very freely when first tapped and produced rubber of evey high quality, not subject to tackiness.

The yields of latex, and consequently of rubber, rapidly fell off durings successive tappings, and the rubber obtained from the tappings was subject to "tackiness." This tendency increased during subsequent tappings ; until some, if not all, of the trees when exhausted by frequent tappings, yielded latex from which coagulated latex was not obtainable. It was noted that the tapped parts of the trees ran practically dry of latex after from three to six successive parings.

There were no signs of wound response.

When the lower part of the trunk of a repeatedly tapped tree was practically exhausted of rubber-yielding latex, the higher parts of the trunk yielded latex in relatively large quantity ; and while the rubber from the latex of the lower part of the tree might be very 'tacky' or more or less resinous and coagulable with difficulty, that yielded by the upper parts was of very good quality.

The wounds made on the bank of the trees during tapping were found to heal very slowly and unsatisfactorily.

The tendency to "tackiness" was much more noticeable in biscuits prepared from the latex than in carefully prepared self-coagulated 'scrap.'

A few figures will no doubt be of interest. During a period of two years the yield of dry rubber from mature *Sapium Jenmani* trees of various sizes from 30 to 92 inches in girth at 3 ft. from the ground—the great majority of them, however, measuring between 40 and 70 inches in circumference—was 18.33 oz. per tree. The trees were tapped up to a height of 6 or 7ft. from the ground and were bled to practical dryness. The proportion of rubber appeared to vary considerably. The latex obtained in 1908 yielded about 18% of dry rubber, that of two trees tapped for the first time in 1910 contained 15%, while that yielded by trees which had been subjected to tappings during several periods, contained about 11%.

The percentages of " rubber " in the dry rubber of the biscuits of the various qualities was found by analysis to be

	" Rubber" in Dry Rubber
Excellent rubber from first period ..	..94.5%
Weak, inclined to be tacky, from 2nd and 3rd periods	..93.6%
Quite soft and very tacky from 3rd period ..	..92.4%
Soft, tacky resinous, coagulated mass from 4th period	..81.3%

The proportion of " chemically pure " rubber extracted on analysis varied in similar fashion.

The Future of Rubber.

Some people have assumed that the price of rubber must go down considerably, in consequence of the increased production. As a man who has some interest in rubber planting, I earnestly hope that it will, for it is a mistake to imagine that the price of rubber must necessarily, if it goes down, interfere with the return on the capital. The amount that up to the present is being won from the matured trees will be enormously increased in the near future, and the increased yield of the matured trees will more than compensate for a decrease in price that will bring the rubber industry into an entirely different horizon. Manufacturers who are here represented are only waiting for rubber at a reasonable price to enable them to look forward to a limitless expansion of the horizon of the rubber uses There are scores of directions in which manufacturers are only waiting for that time to come in order to enlarge their manufactories at once, and when that time comes rubber will be as staple a produce all over the world as wheat.

—Sir Henry Blake, G.C.M.G. at the opening of the Rubber Exhibition, London, 1911.

Board of Agriculture.

THE PRESIDENT'S FAREWELL.

HIS EXCELLENCY the Governor (Sir F. M. Hodgson, K.C.M.G.), presided over a meeting of the Board of Agriculture on Thursday, July 27; there being also present the Chairman (Professor J. B. Harrison, C.M.G., M.A.), the acting Assistant Director of Science and Agriculture (Mr. S. H. Bayley), the Chairman of the Local Government Board (Dr. J. E. Godfrey), the Commissioner of Lands and Mines (Mr. F. Fowler), the Economic Biologist (Mr. G. E. Bodkin, B.A.), the Government Veterinary Surgeon (Mr. J. Raleigh, V.S.), Messrs. J. Gillespie, H. L. Humphrys, J. Monkhouse, W. M. Payne, O. Weber, J. Brumell, J. Wood Davis, F.R., and T. Earle.

NEW MEMBERS.

The appointment of Messrs. H. L. Humphrys (Manager of Pln. Non Pareil), J. Wilson (Manager of Pln. Uitvlugt), G. E. Bodkin, B.A. (Economic Biologist), and J. Raleigh (Government Veterinary Surgeon) to seats on the Board was announced, as well as the resignation of Mr. R. G. Duncan.

THE LATE REV. F. C. GLASGOW.

His Excellency referred in sympathetic terms to the death of the Rev. F. C. Glasgow, and moved that there be recorded on the minutes of the Board the regret of the members at his death and the esteem in which he was held by the Board and by the general community; and that a copy of that record be sent to Mrs. Glasgow and her family.

Professor Harrison followed in similar terms and added that he and his officers could always go to Mr. Glasgow for information and could get it, no matter what trouble Mr. Glasgow put himself to, especially in connection with the West Coast and West Bank districts.

The motion was agreed to unanimously.

WILD BIRDS.

Professor Harrison submitted a report from the Wild Birds Committee, announcing the appointment of Colonel De Rinzy and

Rev. Father Dawson, S.J. as co-optative members of the Committee—the former as a sportsman and the latter as a scientific ornithologist.

MODIFICATION OF CLOSE TIME FOR CERTAIN BIRDS.

Professor Harrison announced that it had been found convenient to alter the close time for ducks and pigeons to "from April 1 to July 1," and for scarlet ibis to September 1. In reply to Mr. Wood Davis, Professor Harrison pointed out that rice-growers were already protected, the clause "except in rice-fields" having been inserted.

CONGRATULATIONS TO ROYALTY.

His Excellency informed the meeting that a congratulatory telegram had been sent to Their Majesties by the Board through the Secretary of State. The Board approved.

DEMERARA RUM.

Professor Harrison said that there had been obtained from Australia and other colonies (where they had reason to know that Demerara rum was mixed with silent spirit and sold under various names) the local laws dealing with the sale of pure food and drugs, but there was nothing in those laws by which the vendors of these mixtures could be reached. He thought it best to carry the matter no further at present.

THE RUBBER EXHIBITION IN LONDON.

A vote of thanks to Mr. Stockdale was unanimously carried for his work on behalf of the colony at the International Rubber Exhibition held at the Agricultural Hall, London, in June and July, Professor Harrison remarking that they might be quite sure that Mr. Stockdale had done his best for them even if he had not got quite as much money as he would have liked for the purpose of running the British Guiana court.

EXPORT DUTY ON BALATA AND RUBBER.

Professor Harrison announced that His Excellency had approved of cultivators of rubber and balata, who sold only the product of the lands they occupied, being exempt from the export duty provided in section 57 of the Tax Ordinance.

THE D'URBAN RACE COURSE.

The D'Urban Race Course having reverted to the Crown, it was handed over to the control of the Executive Committee of the Board. It was stated that the bulk of it would be kept open for the good of the town, but the eastern part would be taken on to extend the Experimental Fields of the Board of Agriculture.

MR. QUELCH'S GREAT WORK.

Mr. Humphrys having introduced a motion expressing regret at Mr. Quelch's resignation and thanking him for the work which he had done in the colony—a work which the Board recognized as very valuable; and Mr. Gillespie having seconded, Professor Harrison supported the motion. He regarded Mr. Quelch's visit to the colony as of more far-reaching importance than merely the destruction of the *Castnia licus* or its reduction in numbers. Mr. Quelch had had the opportunity of going all over the different cane-fields in the colony—an opportunity which the officers of that Board could not have as they had so many other things to do. Mr. Quelch had done that and had shown that *Castnia licus* and other similar plagues or pests could not be overcome by spasmodic efforts, and he had also been able to point out to planters generally that for years back they had been pursuing a course which must end in the destruction of the fertility of their fields. That point—the destruction of the fertility of cane-fields by wholesale burning—was no new one at all. It had been pointed out over 20 years ago by the scientific officers of the Colonial Sugar Refining Company in Australia, who were sent to a great many cane countries to work out systems of getting pests under control, and they reported at the time that the wholesale burning of cane-fields which many people believed was the panacea for insect pests was tending to their increase—not only were the pests destroyed, but enemies of those pests were also destroyed, and that did more harm than good. In addition the fertility of the soil was destroyed. Of course they all knew that in many cases the wholesale burning of the cane-fields was followed by a considerable increase in the crops—that was quite right and exactly what ought to be. The singeing of the land destroyed certain harmful organisms that were in the land and therefore increased the fertility, but while that might be a useful practice for a few years, depending on the nature of the land, its continuous pursuit year after year must mean absolute destruction of the fertility of the soil. They would be destroying their permanent capital. One of the most important features of

Mr. Quelch's visit was that he had been able to impress that point upon all the planters he came across. But they knew that there were some planters who personally did not agree with Mr. Quelch's views; however, the Professor felt sure that in time to come it would be brought home to them that Mr. Quelch was right.

THE GOVERNOR'S TRIBUTE.

His Excellency said that before putting the motion to the vote he would like to say that in his judgment Mr. Quelch had done very valuable work, not only for the planters who were immediately interested in his work but for the colony generally. The Board now had a great deal more information than they had before. Mr. Quelch was a hard-working man, and he took care to get the utmost information possible upon any subject upon which he was engaged. The results of his work had been communicated to the planters concerned, but he was also communicating them to the Government, and the information which the Government would then have would be very valuable indeed. Mr. Quelch did his work in a very able and thorough manner, and His Excellency thought the thanks of the colony were due to him for that work and the information which had resulted from it. He liked to mention this because he thought it was due to Mr. Quelch that his work should be looked at not only from the local standpoint, which, of course, was very valuable, but also from the standpoint of the good which it had done to the colony. (Applause.)

The motion was then carried.

THE DUTCH COMMISSIONERS.

In connection with the visit of the Dutch Royal Commissioners who passed through British Guiana on their way back from Surinam to Holland, Professor Harrison remarked that they agreed with every recommendation made by the delegates from British Guiana who visited Surinam in connection with the Banana Commission, and added that Dr. Cramer made the observation at the Polder that the coffee was being attacked by a "witch broom" disease similar, but not identical, with that attacking cacao. That, the speaker considered, was a very valuable observation and one which amply repaid the colony for the entertainment the colony had afforded the visitors.

THE GOVERNOR'S DEPARTURE.

Mr. J. Wood Davis moved the following resolution :—

> "On the eve of the departure of His Excellency the Governor the Board place on record their thanks to and high appreciation of the keen and unabating interest and assistance which His Excellency displayed and the encouragement which he gave not only to the members of this Board but also to the agriculturists of the colony, the benefits of which they feel will be experienced for many years to come. The Board assure His Excellency that he takes with him in his retirement from the colony the best wishes for his good health and prosperity, and respectfully extend the same good wishes to Lady and Miss Hodgson."

Few words, said Mr. Davis, were needed from him in support of the motion. There were several things which could be said both there and elsewhere in testimony to the general statement that had been made, that of all previous Governors of this colony none had worked so hard in the general interest of every section of the community as His Excellency Sir Frederic Hodgson. He thought that running concurrently with the interests of the Board were several branches which included the important scheme of irrigation which His Excellency had succeeded in forming and which in the near future must benefit the small land-owner and assist the agricultural interests of the colony. His Excellency had continually interested himself in the extension of the good work of the Local Government Board, and that statement must also be made with regard to the Board of Agriculture.

LAND AND LOANS.

It was due to His Excellency to say that he had encouraged legislation and arrangements whereby suitable land settlements might be obtained, not only in the far interior but adjoining the Railway Company's line, Clonbrook and Triumph, for instance. That those lands would in the near future be beneficially kept and thereby tend to the encouragement and betterment of the people could not be doubted. He would also refer to the interest which His Excellency had taken in the extension of roads in the interior, and, above all, to his interest in the poorer classes of the community. Apart from his work in connection with education and adapting it to agriculture, His Excellency had launched a scheme of Co-operative Credit Banks which would be of far-reaching benefit and

importance to small agriculturists. His Excellency had undoubtedly, by the acclamation of intelligent and honest inhabitants, identified himself with the best interests of the colony, and on his leaving these shores the deepest regret would be felt. There would also be a feeling of gratitude for the good work which His Excellency had done.

Mr. Payne seconded the motion and endorsed the remarks made by Mr. Davis.

ON BEHALF OF THE DEPARTMENT.

Professor Harrison, on behalf of the officers of the Board and his department, said that ever since His Excellency had arrived in the colony they had received every possible encouragement in their work. At times they had been a little depressed that their work did not produce results as rapidly as expected, but His Excellency had taken that depression from them by the way in which he had interested himself in the details of the work and grasped all the difficulties, which were great. They most highly valued the assistance His Excellency had given to them invariably on behalf of the Board, the agriculture of the colony, and its development on scientific lines.

THE GOVERNOR'S REPLY.

His Excellency, in reply, said he had been very touched by the remarks made. Since he had been in the colony he had witnessed many changes with regard to agriculture. People had come to the colony to invest their capital in it in far larger numbers than previously, and he put that down to a great extent to the way in which the Department of Science and Agriculture, the Commissioner of Lands and Mines, the Local Government Board, and those connected with agriculture had done their work. From all of them he had received the utmost assistance on every occasion. There had come into the colony people asking for rubber concessions, and regulations had been passed dealing with those concessions, with the result that concessions could be obtained in this colony as cheaply and as well as in any part of the world. Balata had been sought for by various companies, and they had one enormous company doing the business of various smaller companies that existed previously.

TIMBER.

With regard to timber, he had just come back from a visit to Cartabo Point. There they had a company with American capital interesting itself in timber. It was going to construct a railway with a standard gauge of 4ft. 8in. from Cartabo Point to Peters

Mine. In the first instance, the company would take the railway six miles, which would take them beyond the part at which the trees had been cut down already, and it would put up branch lines on either side for the purpose of bringing the timber from the adjacent land. And, as the company took that timber away, it would proceed inwards with the railway, until the objective, which was the Peters Mine, 72 miles away from the Point, was reached, and in the near future—it all depended upon the rate of progress —Peters Mine would be galvanised into life and do some good for the colony. He had witnessed a large addition to the cultivation of rice. He had been in the position of having to contend with a loss of revenue in consequence of the diminution of imports of rice. He was quite well aware that it was very desirable to leave rice unhampered, and the result had shown the wisdom of the step, for although they had lost revenue and taxation became somewhat higher than would otherwise have been the case, yet in the end it would be a good thing for the colony. The cultivation of rice had gone ahead extraordinarily.

MINERAL OIL.

They had people looking for mineral oil, and when the regulations had been framed and put in their hands they would begin to work for the purpose of searching for oil in real earnest. He hoped those regulations would reach the colony in about four or six weeks' time, and when they came no time would be lost in putting them into the hands of those interested. He had seen a great improvement in the breed of cattle, and thought they could hold their own with the cattle in any West Indian colony. At Onderneeming he saw cattle brought from Barbados. He was not struck with them, and thought they had gone ahead so much in this colony that they could return the compliment to Barbados.

ABORIGINALS AND RUBBER.

With regard to rubber there had been an arrangement come to in conjunction with his friend the Commissioner of Lands and Mines to open up the Indian Reserves for rubber purposes. The arrangement was that the Indians would have the benefit of the rubber within their reserves. The regulations had been framed. Two large quantities of balata had been sent down to headquarters and sold. The Indians were paid a fair price for their labour, somewhat higher than they would get in the open market, and the proceeds of the sale after deducting all expenses were put in the Post Office Savings Bank. When the money accumulated a good deal could be done with it in the way of helping the Indians in many

ways. The Ordinance of which he felt most proud was the Local Government Ordinance, and no one knew what had been done under that Ordinance except the people themselves. The Polder Ordinance was a good measure. There were minor industries established since he came to the colony, such as the lime industry and the sisal hemp industry. The latter might be discarded at the Penal Settlement in favour of rubber. There were 30,000 trees already growing and in a short space of time the number would be doubled. He must thank them all for the assistance they had given him always, and he also thanked the Director of Science and Agriculture, whose worth the colony did not appreciate to the full. He had known the Professor for seven years and there was not a harder-working man nor one who put more heart into his work. One of the Professor's positions was that of Chairman of the Board of Education. The Professor and he agreed that the educational lines were not right. They ought to tend more to agriculture than at present. They had taken one step in that direction, but there were others to take. They must have a contented body of teachers, who would take an interest in their work, and who would have nothing to think of with regard to their salaries but devote their whole attention to the children in their charge. They must be careful also to train the teachers as well in agriculture. With regard to the agricultural school, that would do an immense amount of good. There would be a considerable increase in the surplus this year, and therefore they would be able to make a start with the school. In conclusion, His Excellency expressed the hope that the work of the Board would continue to have excellent results.

The resolution was carried unanimously and the Board adjourned *sine die.*

The Rationale of Grafting.

A very brief explanation will show why grafting and budding are necessary. None of our choice varieties of fruits come true to the parent from seed ; and very few of those that can be raised from cuttings or layers are suitable. Therefore, having raised a new and choice variety from seed, or otherwise—and having only the one tree or bough—the question arises how to propagate and increase such a variety, at the same time keeping it true to the parent or sport, so that it may be cultivated extensively or otherwise, if necessary. To increase such a variety, the art of grafting and budding must be resorted to.

—C. F. Cole, Inspector, Vegetation Diseases Act, in "Journal of Agriculture," Victoria (Australia), June, 1911.

Hints, Scientific and Practical.

Physiography as a School Subject. PHYSIOGRAPHY can be made to brighten the intelligence of the schoolboy, and to prepare the way for more special studies if it is based upon direct observation and comparison. It may well begin with outdoor object lessons on natural phenomena, which gradually become continuous and interdependent. We must, as in any other science, make sure that the boys really do the work for themselves, and are not merely lectured to. No subject gives greater facilities for a string of information lessons, without value to the formation of character. Even the luminous and interesting manual of Huxley is open to objection on the ground that it tells too much and explains too much, besides dwelling upon things of which the schoolboy can have no immediate knowledge. But some of the later text-books of physiography are mere encyclopædias, devoid of educational value to the schoolboy. The real test of the teaching is to ask; "What has our physiography led the children to do for themselves?" If there are no maps, or models, or collections to point to as the outcome of the lessons, it is likely that the time has been wasted. An enterprising and inventive teacher can get splendid work out of the weather, the movements of the heavenly bodies, the form of the ground, the growth of deposits, the waste of sea-cliffs, the traces of ice-action, the history of a fossiliferous rock or of a bone-yielding cavern. He can press into the service any knowledge of physics or chemistry, any skill in drawing, photography or surveying, any enthusiasm for rambling or collecting, which his pupils possess. It is often a difficulty to any but a teacher of real originality that no text-book is suitable to every district. Perhaps the very best features which the neighbourhood affords are undescribed in text-books.

—Prof. L. C. Miall, F.R.S., in "Teaching and Organisation."

The "Candying" of Honey. ALL liquid honey is liable, sooner or later, to candy, or granulate; that is to say, it becomes first cloudy and gradually, partially and wholly solid.

Honey consists principally of two sugars—dextrose and levulose. The former assumes a crystalline form much more readily than the latter; and it is therefore chiefly the relative proportions of these sugars upon which the rapidity and degree of granulation depend.

The preponderance of the one or the other is due to the flora from which the nectar was obtained by the bees. There are, however, some other factors in addition which hasten or retard granulation. These are temperature, amount of water, pollen grains, and air bubbles.

Generally speaking, honey does not granulate until the approach of cool weather; and honey gathered during cool weather candies sooner and firmer than that which is produced in midsummer. Any honey, however, will granulate sooner when subjected to frequent changes of temperature, than when kept at a uniform degree—high or low.

The amount of water naturally present in honey varies according to the source of the nectar, the humidity of the atmosphere at time of gathering, and the length of time it remained in the hives. In Victorian honey it ranges from 12 to 25 per cent. As water is necessary to crystallization, the thinner honeys naturally granulate more readily; while some of the dense honeys produced in the dry parts of Victoria remain clear and liquid for one or two years.

Pollen grains, which are always present in honey, have no doubt some influence in the granulation of honey in acting a nuclei of crystallization. At any rate, it is certain that the honey from those Eucalypts from which bees gather an abundance of pollen, such as Red Gum and Grey Box, granulates very quickly, while that from Yellow Box and Red Box, producing little or no pollen for bees, remains liquid considerably longer.

When the modern method of removing the honey from the comb by centrifugal force in the honey-extractor was first adopted, it was soon found that extracted honey candied sooner than strained honey, that is, *honey obtained by bruising the combs and straining through bags.* This greater liability to granulation in extracted honey is due to the minute air bubbles incorporated during the process of extraction.

Clear honey always realizes a better price than cloudy or congealed; the latter is the trade term for candied. Producers should therefore aim at their honey remainining clear and liquid as long as possible. This can be accomplished by the removal of the factors which hasten granulation, namely, excess of moisture, pollen grains and air bubbles.

In a moist district, or any district late in the season, honey should not be extracted until the combs are well sealed over. When ex-

tracting the honey, it should be heated to 160 degrees (Fahrenheit) before being poured into a settling tank. This can be done by drawing the honey into open 60lb. tins, and standing these in hot water until the required temperature is reached. Honey, when hot, is almost as thin as water. Thus, in the settling tank, air bubbles, pollen grains, and fine particles of wax rise to the surface, while a percentage of water is evaporated at the same time.

In some of the larger apiaries an apparatus for heating the honey is inserted between the honey gate of the extractor and the settling tank, to which the honey finds its way by gravitation. It may be drawn off, while still slightly warm, into tins ready for market. Honey thus treated remains liquid for many months, presenting a smooth, clean surface when sampled.

If, when kept for a long time, it does candy, it may be re-liquefied, and will not throw up a layer of froth as will honey not previously heated. In liquifying candied honey, great care should be exercised not to spoil it by over-heating. The temperature of the water in which the tins are placed should not exceed 190 degrees. The melting cannot be forced without spoiling the honey. A 60lb. tin candied solid will take four hours to liquify. By over-heating, the flavour and colour of the honey may be spoiled, and yet a little solid piece remains in the tin, from which granulation again commences almost at once. When many tins are to be dealt with, speed should not be attained by increasing the temperature and reducing the length of time, but by setting a greater number of tins going at the same time.

—F. R. Beuhne, Bee Expert, in the "Journal of the Department of Agriculture of Victoria" (Australia), June, 1911.

Painting to Preserve Timber.

It has long been recognised that much may be done to increase the durability of timber. It is for this purpose that outside woodwork is often painted, though incidentally the appearance of the object so treated may also be improved. The intention of applying a coat of paint or similar material is to exclude moisture, because it is known that decay of wood—as of all other vegetable substances—is in some way connected with the presence of water. In a sense this is only half a truth, because wood may be saturated with water and yet may show great resistance to decay. This is illustrated by the fact that the wood-work of Roman bridges has been removed from the beds of rivers in a comparatively sound condition after immersion for nearly 2,000 years. Similarly in the

case of peat bogs, from which the trunks of trees in a perfectly sound condition are removed after having lain for many thousands of years. We have another example of the perservation of wood through the agency of water in the so-called "ponds" that one sees alongside many tidal rivers, where imported timber is often kept for years in a much better state than would be the case were it piled on shore.

The fact is that whereas moisture is a necessary condition of decay, it cannot act in this way unless assisted by air, and air is practically absent in wood that is saturated with water, as in the piles of bridges, in bog-oak, and in timber immersed in tidal "ponds." Water and air are both essential conditions of decay, and both must be present to facilitate decomposition, that is to say, wood may be completely permeated with air, and yet will remain sound if no water is present, or it may be completely saturated with water in the absence of air, and yet show but little sign of undergoing decomposition. But if both water and air are present in wood to a sufficient extent, then the conditions of decomposition are at their best, and decay will proceed more or less rapidly, the rate depending on the temperature. The reason for this is that the destruction of wood by the process of rotting depends on the work of living organisms, especially fungi, and just as moisture, air, and a suitable temperature are necessary factors in the growth of higher plants, so are they necessary conditions in the destructive growth of the lowly plants that induce decay in structural timber. When, therefore, a coat of paint is laid upon wood it assists in its preservation, because it excludes moisture, and, to some extent, air, but it will only be effective if the wood has been thoroughly dried before the paint is laid on. Should the wood be wet to begin with, or imperfectly seasoned, painting it may do more harm than good, because the moisture will be imprisoned and prevented escaping, and conditions favourable to decay are created and maintained.

Besides oil paint, several other substances are used to waterproof wood, such as coal tar, and although the latter is objectionable from some points of view, it makes an excellent coat, which, being more or less elastic, admits of the contraction and expansion which the wood undergoes under the influence of changes of temperature. A coating that cracks readily is quite unsuitable, because through the openings thus formed water and the spores of fungi gain an entrance and decay is rapidly set up.

—Prof. W. Somerville, M.A., D.Sc., in "The Journal of the Board of Agriculture" (England), July, 1911.

A Criticism of Examinations.

We have come to estimate school science almost exclusively by public examinations. Subjects which do not count for much in recognised examinations (*e.g.*, geology) are little taught, and every course is made to conform to some examination syllabus or other. The examiners, to whom the direction of studies is thus entrusted, are as a rule more distinguished by their special attainments than by their familiarity with educational ideas. For their own comfort, and for the sake of even-handed justice, they like to proceed upon the most definite lines. To discover knowledge and ability is less their object than to mark consistently. Hence they incline to dwell on those parts of the subject which admit of exact statement, and to discourage those which though less exact, are more permanently useful. Almost every examiner, consciously or unconsciously, favours grammar, and discourages literature; favours historical dates, and discourages biographical detail; favours numerical accuracy, and discourages experiment; favours learning by heart, and discourages independent thought. I have myself for many years sent up students to examinations which I thought more or less unwise. Both the students and I have suffered hardship in consequence; the men have not had a fair opportunity of showing what they could do, and they have often lost credit because they had not got up a particular set of technical terms. But on the whole I do not doubt that the best policy is to teach as well as we know how. Good teaching has its effect even upon an unenlightened examiner, who cannot help marking high the papers that show real grasp of the essentials of the subject. It is of less consequence that he does not discover all that we think good in our own candidates.

An exaggerated estimate of the value of examinations is a great obstacle of progress. We shall some day learn that examination, especially when carried on by written papers only, is a rude and imperfect test; it should be made accessory and not principal; it should never be allowed to dominate the course of study, even when the examiner is unusually strong both in knowledge and practical skill. Teaching with minute deference to another man's syllabus is at best a form of slavery. The more perfect the examination machine becomes, the less does it agree with that spirit of life and freedom which pervades all really good teaching.

—Prof. L. C. Miall, F.R.S., in "Teaching and Organisation."

Nitrogen.

Physiological Action of Manures.

Nitrogen is mainly concerned with the vegetative growth of the plant, with the formation of leaf and stem that are the necessary preliminaries to complete development. A deficiency of nitrogen results in a stunted general growth, in which the grain or seed bears a high proportion to the whole weight of the crop ; the plant on analysis, however, shows no marked lack of nitrogen as compared with the other constituents. These other bodies, phosphoric acid, potash, etc., in whatever excess they may be present in the soil, are only taken up by the plant as it can use them, *i.e.*, in quantities proportionate to the nitrogen supply. As the amount of available nitrogen is increased, the development of leaf and shoot increases, their green colour deepens, and maturity becomes more and more deferred, so that a crop grown on land over rich in nitrogen always tends to be late and badly ripened, and to show a profusion of leaf characters which, in the case of a grain crop, often result in lodging before harvest. But the fact that the primary growth of the plant is up to certain limits almost proportional to the supply of nitrogen, so that an application of nitrogenous manure has a quickly visible effect, not only makes it the leading constituent of a fertiliser, but is apt to give it a fictitious importance in the farmer's eyes. One of the most important effects upon plants of an excess of nitrogen is their increased susceptibility to fungoid attacks of all kinds ; for example, rust is always much more abundant upon wheat which has been heavily manured with nitrogen, just as it appears on normally manured wheat whenever the character of the season has been such as to induce a specially rapid production of nitrates while the plant was making its growth, as when great heat and moisture come together . . . . The association of high nitrogenous manuring with susceptibility to disease may be seen in all plants ; it is often very manifest in green-houses where crops are grown in specially rich soil, nitrifying very rapidly owing to the high temperature prevailing. The dark green aspect of the leaves of such plants is generally evidence of the excessive amounts of nitrogen they are receiving, and it is well-known that if any fungoid disease makes its appearance it is very difficult to keep in check and often destroys the whole crop with great rapidity.

Phosphorus.

Just as nitrogen delays maturity by promoting growth, *phosphoric acid* has an opposite effect ; it is in some way closely bound up with grain formation, being always found in greater proportions in the

reproductive parts of the plant than elsewhere. The ripening action is very clearly seen in the Rothamsted experiments on barley ; the plots without phosphoric acid being as a rule about a week behind those which receive this fertilizer. . .

The phosphoric acid increases the proportion of grain to straw and decreases the nitrogen content of the grain.

The action of phosphoric acid on the plant is not, however, confined to its ripening effect ; it stimulates the early development of the young seedling to a remarkable extent. Farmers are well acquainted with the good start that any crop gets when manured with superphosphate ; indeed, it is often used merely to secure a better plant, though with little expectation of otherwise increasing the yield. More than sixty years ago this had been noticed by the late Sir John Lawes ; and in one of his earliest papers on "Turnip Culture" in 1847, he writes : "Whether or not superphosphate of limes owes much of its effect to its chemical actions in the soil, it is certainly true that it causes a much enhanced development of the underground collective apparatus of the plant, especially of lateral and fibrous root." For this statement he was vigorously attacked by Liebig, but some experiments, which are still in progress, show that it was the result of sound observation and that in some way or other phosphoric acid does stimulate the root development of the young plant. Barley seedlings, for example, grown in water cultures without, or with a nominal amount of, phosphoric acid develop practically no root, whereas when they are nitrogen or potash starved the root growth will be proportional to that of the rest of the plant. Both in the field and in pot experiments the phosphoric acid has a great effect in promoting the formation of adventitious buds, so leading to the tillering of the plant. To what extent this stimulus to root growth is brought about by other sources of phosphoric acid and under diverse conditions of soil, has not yet been worked out, but there can be little doubt but that it explains why a phosphatic manuring has such a valuable effect in establishing the plant, even if the gross yield is not ultimately much enhanced.

Potassium.

To understand the use of potassic fertilisers in the ordinary routine of farming, it is necessary to enquire into the function of potassium in the nutrition of the plant, for the water culture experiments hitherto quoted only demonstrate that it is one of the indispensable elements. Further enquiry goes to show that in some way potash is an essential part of the mechanism of the process of assimilation ; when it is deficient the manufacture of carbohydrates like starch, sugar, and cellulose, is greatly reduced, and in practice

it is the crops rich in carbohydrate which are most dependent upon a full supply of potash. Reed observed that starch grains were not formed in the cells of a green alga immersed in a culture fluid containing no potash, and that those originally present in the chlorophyll gradually disintegrated and disappeared. Some, earlier experiments of Hellriegel and Wilfarth illustrate the dependence of starch formation on potash even more clearly. They started a series of water cultures, in one of which the supply of nitrogen increased in successive jars from nothing to the full amount required for a plant; the other constituents were fully supplied in every jar. In a second series, the phosphoric acid supply was similarly varied, and in a third series the potash. As would be expected, in each series the amount of dry matter grown was roughly proportional to the supply of the constituent which was in defect. Further, when nitrogen or phosphoric acid was lacking the formation of grain was small, but, as far as might be, the grains produced were perfect; a larger number of grains, but not bigger ones, being found as the supply of nitrogen or phosphoric acid increased. Hence the weight of a single grain was fairly constant whether there was much or little nitrogen and phosphoric acid. But when potash was lacking the individual grains were small and undeveloped, and the average weight of each grain increased with each addition of potash. In the absence of potash the assimilation process was at a standstill, hence the grains could not be filled with the starch which is their main constituent. Next to their effect upon carbohydrate-making crops, the most striking action of potassic manures is their value in promoting the growth of clover and all leguminous crops. The function of potash here may be still that of promoting assimilation, because the bacteria which fix nitrogen in the nodules on the roots of the leguminous plants must be supplied with carbohydrate by the plant in order to obtain, by its oxidation, the energy requisite for the fixation of nitrogen. There is evidence to show that the fixation of nitrogen by these organisms is promoted by a supply of carbohydrate; but whatever may be the explanation it is found in practice that the growth of clover, etc., is very much promoted by a free supply of potash, and this is very manifest upon sands and gravelly soils usually poor in potash. This effect may be very strikingly seen when the fertiliser is applied to grass land carrying a mixed herbage, for the potash encourages the leguminous plants until the aspect of the vegetation may be entirely changed. There is abundant experimental evidence to show that potash makes the plant more resistant to the attacks of fungoid diseases. Wheat on the potash starved plots is always subject to

rust, even in a good season when very little is to be seen on the other plots normally manured. The grass also on potash starved plots is attacked by various fungi; hence it may be taken as a general rule, that crops which do not receive their full supply of potash will be correspondingly susceptible to disease.

—A. D. Hall, M.A., F.R.S., in "Fertilizers and Manures."

The African Snail (*Achatina Fulica*) in Ceylon.

Since the publication of my last series of notes, I have visited the scene of the outbreak and found that its magnitude had been by no means exaggerated. The snails were there in their millions. The weight of the individuals only had been misstated. They were reported to turn the scale at one pound and two ounces. The largest specimens that I could find scaled little more than four to the pound. But the extraordinary part of the affair is that, in spite of their overwhelming numbers, the actual damage that they are doing is comparatively small. They destroy a certain amount of vegetable produce, but the general aspect of the country is as green and flourishing as ever. This may be accounted for—to a large extent—by the fact that the snails are principally occupied in scavenging work.

E. E. Green (Govt. Entomologist) in "The Tropical Agriculturist" (Ceylon), Sept., 1910.

The Absorption of Ammonia by Soils.

There remains the question of whether the soil takes in ammonia by direct absorption from the atmosphere. Of course it is well known that the soil is a very effective absorbent of ammonia, and it might be assumed to be capable of taking away from the air even the very small trace which can be determined therein. It must, however, be borne in mind that the soil itself is a possible source of ammonia. The soil organisms are always producing ammonium compounds, so that a small and fairly constant percentage of ammonium salts is to be found in the soil representing the transition stage between organic compounds of nitrogen and nitrates. As most soils also contain some calcium carbonate, which by interaction with the ammonium salts would give rise to ammonium carbonate, and ammonium carbonate possesses an appreciable tension of dissociation at soil temperatures, the soil itself must be capable of giving off ammonia to the atmosphere above it.

—A. D. Hall, F.R.S., and Dr. N. H. J. Miller in "The Journal of Agricultural Science" (Cambridge), May, 1911.

Visits to Country Districts.

ONDERNEEMING.

THE Acting Assistant Director, accompanied by the Government Veterinary Surgeon and the Economic Biologist paid visits to Onderneeming Experimental Station in July and September.

The weather having been favourable for trench-digging this work has been pushed on with energy and it is hoped that before the rains set in all the principal fields will have received attention. The planting of Para Rubber trees throughout the Coffee fields has now been accomplished and the young plants, in spite of the recent dry weather, are looking particularly promising. The experimental tapping of five of the oldest Hevea trees, which was commenced in February last, is nearing completion, and the results will be published in due course. The cacao appears to be practically free of disease, a few thrips only being discovered by the Economic Biologist.

The Board of Agriculture's Shorthorn bull "Sampson" was in magnificent condition, but the cattle and sheep, which depend largely on grazing, were not in such good conditition—a result of the dry weather.

CHRISTIANBURG AND DISTRICT.

The Government Station at Christianburg, and Messrs. Sprostons' properties at Wismar, Rockstone, Greenheart Camp and Cole Glen, have been visited during the quarter by the Acting Assistant Director and Instructor Mansfield, and also by the Agricultural Superintendent accompanied by Agricultural Assistant Hunte. The experimental rubber cultivation at Christianburg has received careful attention from Mr Spence, and the trees are making satisfactory growth.

At Rockstone Messrs. Sprostons are experimenting with Para rubber, and the trees look healthy and vigorous. Mr. Crombie, the firm's representative in the district, is much interested in the experiment, and the cultivation shows signs of care and attention.

At Cole Glen sisal fibre has been tried, but the soil conditions appear to be most unfavourable. The plants are small and stunted and have been badly attacked by some fungoid disease, specimens of which have been collected and submitted to the Economic Biologist for investigation.

OTHER VISITS.

Liberty and Kukuritikooroo Islands, and Aliki, Baboon, and Waipatosi Islands were inspected in September by the Acting Assistant Director, Economic Biologist, and Agricultural Superintendent; while the Economic Biologist also visited several rubber cultivations, and the following sugar plantations:—Leonora, Tuschen, Success, Nonpareil, Skeldon, Rose Hall, Golden Fleece and Anna Regina.

S. H. B.

A Grafting Curiosity.

The tomato is so closely related to the potato-plant, as I have shown in the *Journal* for April, 1910, that potatoes and tomatoes may be produced on the same plant. A tomato shoot may be grafted on to a potato haulm, and there will be tomatoes above ground and potatoes underground. Conversely, if a potato stem is grafted on to a tomato shoot, there will only be tubers borne in the axils of the leaves.

—Journal of the Department of Agriculture of Victoria (Australia) June, 1911.

Rubber as an Investment.

He had been frequently asked what he thought of the present conditions of the industry as an investment, When one realised the vast possibilities in the use of rubber when at a reasonable price there was little ground to fear over-production. All estates on suitable soil and run on sound lines should give remunerative returns, even if rubber fell to 2s. or even 1s. 6d per lb.

—Kelway Bamber, F.I.C., F.C.S. at the Rubber Exhibition, 1911.

The Necessity for Local Experiments in Rubber.

What may apply to one variety (of rubber tree) may not apply equally to other varieties, nor what has been found suitable in one locality under certain geological and geographical or even climatological conditions may permit of differences where those conditions are dissimilar. It appears to me Mr. Petch went to the root of the subject when he stated: "At first planters were influenced by the conditions of European forestry," and, as showing how opinion has altered in the course of time, when he further put it that "In the past 8 by 8 was considered narrow planting, whereas now 15 by 15 comes into the category."

—H. C. T. Gardner, F.C.S., in the "Financier" July 8, 1911.

Agricultural Instructors' Reports.

THE following summaries of the reports of Agricultural Instructors in Country Districts indicate the chief points brought before the Director of Science and Agriculture by those officers, and should be read with interest by farmers and grantholders generally.

BERBICE.

Reports from the Resident Instructor in this County (Mr. W. E. Augustus) are of an encouraging nature and it is satisfactory to read that "the farmers are awakening to the fact that the Instructor takes a real interest in them, and whereas I was at first viewed with suspicion and distrust, I am now received with a much better spirit. The large majority of farmers begin, after the first visit or two, to look out for the Instructor, and are glad to receive advice and try to carry out as far as possible instructions given."

It is not more than about a year ago that this Officer on taking charge of Berbice County complained bitterly of the distrust and almost antagonism which the small farmer exhibited towards him, and as it is essential that he should have the respect and confidence of the men among whom he is working it is gratifying to find that by tact and perseverance he has gained the confidence of the majority.

Mr. Augustus in a recent report says :—"There are many points that only time and perseverance in agricultural instruction will eventually make the farmer carry out in his field. Perhaps the most important of these are good drainage, plant selection, and sanitation of fields, and I am steadily persisting (and, I am pleased to say, slowly succeeding) in inducing the farmers to take up the cultivation of permanent crops as a means of increasing the value of their lands, and also with the object of making them pay greater attention to proper and thorough cultivation. Where plantains and cassava only are cultivated, the farmer tries to get all he can at the least possible trouble and expense, paying no heed to the future. With permanent crops however he will be forced to recognise the value of good cultivation and will then gladly welcome Instructors to his farm."

In another report the same officer writes :—"The spirit shown at the lectures given in the different parts of this district points to a steady awakening in agricultural matters, and the questions asked by many of the farmers present show that agricultural information is being sought after, while the many enquiries as to the cultivation of

permanent crops would seem to prove some beneficial result is being obtained. The many Associations formed in this district by the farmers prove also that some good is being done, and the keen attention which is now being given to the Instructor whenever he visits a farm is distinctly encouraging.'

On the Corentyne Coast the Instructor reports that stock-raising receives much attention, the people cultivating relatively only small areas. Rice is the principal crop but the farmers do not pay any special attention to their fields. Not having a regular supply of water for irrigation purposes but having to depend solely on favourable weather conditions tends to make them cultivate in an haphazard manner trusting more in Providence than in skilful cultivation, and as a result the yield is very often not what it might and should be. The provision farms generally are in fair order, and coconuts on the whole look healthy.

In the Berbice River district the Instructor reports that bad drainage is very prevalent. Cacao and coffee are being planted to some extent among the provisions on several farms, and in some cases are doing remarkably well, while in others poor drainage is doing its work. Rubber (both Para and Sapium) are reported as making fair growth in the county, while on one estate in the Canje Creek the *Hevea brasiliensis* plants of a little over a year in age are stated to be exceptionally well grown and vigorous.

UPPER EAST COAST.

During the month of September all the villages on the Upper East Coast were visited by the Assistant Gardener who writes as follows :—

The drainage condition of most of these villages has been considerably improved by the digging of the trenches. In the majority of cases the cultivation is in a satisfactory condition. In some places the dry weather has affected the young crops, but not to a very great extent, especially where irrigation is practicable.

It is satisfactory to note that the planting of coconuts, as a permanent crop, is being carried on extensively in this district.

I saw no traces of the plantain disease which was prevalent in 1910, and I attribute this to the carrying out of instructions then given. If the farmers in the several districts would put into practice the advice given them from time to time, their troubles with pests and diseases would not be more than they could control. The disease referred to is first noticed by the almost sudden change of the colour of the leaves of the affected plant, immediately after which they droop and hang down. The plant remains in this state for several months before it dies. Some plants are not attacked until after they have borne and the fruits are half-matured, then suddenly they

begin to turn yellow and decay. There are other plants again which show the effects soon after the inflorescence appears, and never go beyond this stage. Where the plants are not affected until after the fruits are set, it does not interfere with the size of the bunch but checks the further development of the fruits. The prevalence of the disease is due principally to imperfect sanitation. I recommended thorough drainage and the application of lime to diseased stumps. All dried leaves, etc., must be burnt, after which the planting of bitter cassava is advisable. The Breadfruit disease is very common in all the villages, and for keeping this in check, I advised the frequent spraying of the fruits with Bordeaux mixture, and the burning of all badly infected ones.

ESSEQUIBO.

Visits have also been paid to farms in Essequibo by the Assistant Gardener. In Wakenaam the provision farms are reported as in fair order but the drainage, as in other districts, is somewhat neglected. Coconuts form one of the principal permanent crops, but they have suffered terribly from the attacks of beetle, and in some places bud-rot disease. The cultivation of rice is extensively carried on on the island and on the whole is in a satisfactory condition.

The farmers at several of the other places visited confine their attention to ground provision only. At "Look Out" however rubber cultivation is being carried on and some of the Hevea trees about 3½ years old have made satisfactory growth and are looking vigorous and healthy.

POMEROON.

The Resident Instructor in the Pomeroon (Mr. Matthews) is able to report that greater attention is at last being paid by the farmers to drainage. He thinks that they are beginning to realise that good drainage is necessary to successful farming. Greater regard is also being paid to the spacing of plants, and although in many instances knowledge of the proper distances is still lacking, the inclination to huddle as many plants as possible into one bed is gradually disappearing. He is also able to report that the cultivation of permanent crops is being considerably extended.

Coffee. The Coffee cultivations are on the whole healthy, particularly Robusta which has received a great deal of attention, and more attention is now being paid to pruning.

Cacao. More attention is being paid to the cultivation of Cacao, but there is room for further improvement. Improved drainage has had a beneficial effect and pruning is being practised.

The provision farms are on the whole healthy and in many instances permanent crops are being planted. S. H. B.

Answers to Correspondents

R.W. (Georgetown).—The beetles you forwarded are *Longicorns*. —*Trachyderes succinctus.* They have been reported from Trinidad as doing damage to cacao trees there, and are also found in Grenada, Guadeloupe, Cayenne and Columbia. In the larval stage they closely resemble the cacao beetle. They are easily recognizable by their long 'horns' and the yellow bar across the wing covers.

O. W. (Georgetown).—The caterpillars you sent for identificagion are the larvæ of a butterfly—*Papilio Anchisiades.* They are common throughout the cultivated portions of the colony, though only recently have they invaded Georgetown. The larvæ in a later stage of maturity give off an exceedingly offensive odour when irritated. The perfect insects show a wide variety of the red markings on the under wings. The larvæ being gregarious during the daytime, may easily be detected and destroyed.

S. P. AND Co. (Leonora).—The small brown pupæ you sent are those of a small fly (*Phoridæ*). They are not truly parasitical on other insects, the larvæ feeding on decaying matter such as dead insects, etc. The flies themselves are small, and may be recognized by their "humpbacked" form and peculiar venation of the wings.

F. (Georgetown).—The larvæ destroying your rose trees are those of a moth, *Sibine trimacula.* They are curious creatures and are quite common on a large variety of garden plants. Care should be exercised in handling them as they are exceedingly well protected with poison spines which will work their way into the skin causing great irritation. They belong to the family *Limacodidae* or "Slug Worms."

G.B.W. (Bartica).—Your guava trees are attacked by the so-called "white fly" (*Aleyrodicus cocois*). Spraying with kerosene emulsion or Rosin wash will clear the trees of these pests. It should be seen that the spray reaches the under sides of the leaves. "Scalecide" is an excellent substitute for kerosene emulsion, and does away with the possibilities of the kerosene oil being used for other purposes than spraying. The makers issue full instructions.

H. M. G. (Potaro).—The winged insects you forwarded belong to the Homoptera, sub-family *Membracidæ.* While the non-winged forms with the long waxy secretion also belong to the same family,

unfortunately they were too dried up for a further identification. Westwood in India records that the quantities of wax secreted by these insects form a favourite food for certain kinds of lepidoptera and 2 or 3 larvæ of a maggot-like nature may frequently be found concealed in the wax of the live insects. This wax is also used by the Chinese for candles and is much esteemed in India.

The Amount of Ammonia in the Air.

Throughout the whole history of agricultural chemistry attention has been fixed upon the ammonia in the atmosphere as a possible source of the nitrogen of vegetation, and without reviewing the early controversy that centred round Liebig, we may agree that the dispute was largely due to the exaggerated opinions then prevailing as to the amount of ammonia in the atmosphere. The most trustworthy determinations are the long series that have been carried out by Levy at Montsouris, and they agree with other determination by Ville, Schloesing and Müntz and Aubrin, showing only from .01 to .02 of nitrogen as ammonia per million of air even in Paris, with a still smaller proportion in the air of the country.

This small proportion of ammonia may reach the soil in two ways:

(1.) It is dissolved out by the rain.

(2.) It may be absorbed directly by the soil.

The amount of ammonia brought down by the rain has already been fully discussed by one of us. The total amount brought down per acre per annum appears to be tolerably constant for ordinary country air despite variations in the rainfall, but it rises considerably in the neighbourhood of towns. Observations as yet unpublished indicate that a much smaller total amount of ammonia is brought down by the rain falling on the extreme western seaboard of Scotland, where the air may be supposed to have received a minimum of contamination from habitations or contact with the land surface.

—A. D. Hall, F.R.S., and Dr. N.H.J. Miller in "The Jounral of Agricultural Science" (Cambridge), May, 1911.

The Model Gardens.

RECORD OF ATTENDANCES.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to March 31; April 1 to June 30; July 1 to September 30; and October 1 to December 31. The totals only of the three quarters during 1907 are given: the records since then are in detail.

QUARTERS.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd to 4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
First	597	731	389	299	187	...	...	...	...	2,203
Second	1,438	860	183	274	243	...	...	...	...	2,998
Third	¶1,698	976	440	199	212	...	...	...	...	3,552
Fourth	1,714	819	465	115*	411†	160‡	...	...	...	3,684
1909.										
First	1,638	710	338	463	370	302	...	...	...	3,821
Second	1,707	677	329	142	288	446	...	...	...	3,589
Third	¶1,252	742	433	436	172	378	223‖	...	...	4,636
Fourth	1,876	536	438	236	362	771	439	...	...	4,858
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	1,093	385	910	627	361	297	543	441	639	5,296

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.
¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to October 13, 1911. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1908	1909	1910	1911.
	January 1 to October 13.			
Sugar, tons ...	59,624	62,002	46,920	52,835
Rum, gallons ...	1,203,635	1,322,195	1,626,480	1,542,067
Molasses, casks ...	164	426	631	879
Cattle-food, tons ..	3,727	5,799	4,751	3,287
Cacao, cwts. ...	885	533	443	798
Citrate of Lime, cwts.	13	49	76	56
Coconuts, thousands	152	450	681	682
Copra, cwts. ...	..	423	210	1,038
Coffee, cwts. ...	57	1,120	978	925
Fruit, brls. and crates	50	1	..	...
Ground Provisions, value	$1,765 06	$216 32	$546 12	...
Kola-nuts, cwts. ...	...	38	9	...
Rice, tons ...	2,712	3,741	4,141	1,883
Rice-meal, tons ...	1,937	1,448	1,555	974
Starch, cwts. ...	...	...	4	...
Cattle, head ...	1,241	789	1,049	832
Hides, No. ...	2,979	2,549	4,574	3,152
Pigs, No. ...	585	708	872	1,013
Poultry, value... ...	$ 229 72	$184 20	$ 67 08	...
Sheep, head ...	32	53	122	40
Balata, cwts. ...	6,521	5,647	6,570	5,712
Charcoal, bags ...	59,166	61,772	71,222	55,956
Firewood, Wallaba, etc., tons ...	5,670	6,709	7,509	8,130
Gums, lbs. ...	854	6,512	1,507	3,246
Lumber, feet ...	45,248	175,622	202,027	310,131
Railway Sleepers, No.	1,000	2,500	5,700	3,920
Rubber, cwts. ...	40	45	12	23
Shingles, thousands	2,291	1,332	1,802	2,035
Timber, cubic feet	157,333	221,066	222,681	161,556

Selected Contents of Periodicals.

British Guiana under Dutch Rule.

—Colonial Office Journal, July, 1911.

Report of Agriculture, F. M. States, 1910.
Rubber Notes.
Agriculture and Forestry in Hawaii.
A Note on the Canker of Hevea brasiliensis.

—Agriculture Bulletin, S.S. and F.M.S. August and July, 1911.

The Growth of the Co-operative Movement in Denmark.
The Identification and Eradication of some Common Weeds, I, III.
The International Agricultural Conferences at Madrid. (Septr.)
Tobacco Growing for Insectidal Purposes.
Forestry in Norway.
Human and Animal Tuberculosis.
The School of Agriculture, Cambridge.

—The Journal of the Board of Agriculture (England) August, 1911.

Contagious Abortion (in Cattle.)

—The Queensland Agricultural Journal, June, 1911.

Propagation of Fruit Trees.
Citrus Fruit Culture.

—Journal of the Department of Agriculture of Victoria (Australia) June, 1911.

Contiguity in Agricultural Matters (June.)
Continuity in Agricultural Matters (August.)
The Germination of Hevea Seeds. (July.)
New Uses for Rubber.
Tobacco Cultivation in Ceylon.
Curing Rubber. (June.)

—The Tropical Agriculturist (Ceylon), 1911.

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Directions to Correspondents.

Notice.—Letters should preferably be written on one side of the paper only, and as far as possible, each letter should deal with one subject only, to allow of its being referred to the officer who is concerned with the subject.

Officers should be addressed by their titles, not by their names, to prevent confusion with private letters and to ensure that official letters are opened in their absence.

Letters should be addressed—according to the nature of their contents and the business dealt with —to either

The Director,
Department of Science and Agriculture,
Broad Street,
Georgetown.

or

The Government Botanist,
The Botanic Gardens,
Georgetown.

If intended for

The Editor,
The Journal of the Board of Agriculture,

or The Economic Biologist.

or The Secretary of the Board of Agriculture,

letters should be sent to

Broad Street,
Georgetown.

Parcels should always contain the name of the sender. If this is not done, it is often impossible to tell from whom they come, in the case of several arriving at the same time.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. V. JANUARY, 1912. No. 3

The Agricultural Conference.

THE choosing of Trinidad as the scene of the eighth Agricultural Conference in the West Indies insured a large attendance and a representative gathering. The tourist season was in full swing, the weather promised set fair, distinguished societies in England promised to send delegates, matters of great interest were down for discussion, and on its lighter side the programme was an attractive one. Sugar, cotton, cacao, rubber, plant diseases, insect pests, and agricultural education were the main items brought up during a very busy week and all received a good deal of attention, while rice, though not on the official list, yet found a place. Many papers were read and a few were not; though these last will no doubt appear in the official report of the proceedings. Some discussion took place, although the limited time at the disposal of the President prevented him from giving the delegates their "head," as it were. After all, the benefit of these Conferences is perhaps to be found not so much in the official proceedings which take place in the Conference Hall as in the private discussions which arise so freely when members meet in friendly converse. Then it is that information and ideas are mutually exchanged and points thrashed out unhampered by the rules of debate. We hope in our next number to devote considerable space to such papers as were of special importance to British Guiana and to dwell at some length on the more important points in connection with them. To recapitulate; after a comprehensive address by the President, Dr. Francis Watts, C.M.G., D. Sc., F.I.C., F.C.S., Commissioner of the Imperial Department of Agriculture in the West Indies, the delegates settled down to routine work and listened to an interesting paper by Professor Carmody on agricultural progress in Trinidad and

Tobago. In the afternoon they attended a reception and garden party at Government House and in the evening of the first day, Tuesday, January 23rd, they listened to two lectures illustrated with lantern slides, one by Mr. J. B. Rorer, the Trinidad Mycologist, on "Colour Photography" and the other by Mr. W. G. Freeman, the Assistant Director of Agriculture in the island, on "Notes on Some Agricultural Activities in Trinidad." Wednesday saw the delegates at St. Clair experiment station by half-past seven in the morning, where Mr. P. L. Guppy gave an excellent demonstration of methods of trapping cacao beetles and Mr. Rorer sprayed cacao trees with the latest and most improved machines. The morning session at the Victoria Institute—where the Conference was held—was devoted to cacao; the afternoon to sugar. At both of these the delightful series of water-colour drawings by Miss van Nooten, showing the different varieties of cacao and sugar cane cultivated by the Department of Science and Agriculture of British Guiana, proved quite a feature, exhibited as they were by the Director himself and used by him to illustrate his remarks. On Thursday morning early the tram car system of Port-of-Spain and the workshops were visited by special invitation of the company, and then, till noon, the delegates discussed plant diseases and pests and the coconut, lime, and fruit industries. In the afternoon the visitors had the choice of three excursions—to the River Estate, to the Cacao Estates in Santa Cruz Valley or to the Educational Institutions in Port-of-Spain; the first two proving considerably the most popular and affording charming and instructive afternoon trips. On the Friday the Hon. Thomas Cochrane chartered the R.M.S. "Balantia" and treated the whole company to a voyage to the oilfields at Guapo; and such a good day's entertainment did he afford that there was barely time in the evening for Dr. Cramer, the Director of Agriculture in Surinam, to give his eagerly expected lecture on Rubber Cultivation in the East—and elsewhere. For those who hurried over their dinner to hear the accomplished Hollander the evening proved well spent.* Saturday was devoted to cotton, agricultural education and a visit to St. Augustine and the Government Farm, where Professor Carmody held an "At Home," and concluded with the Conference dinner, which proved a somewhat ponderous affair lasting well over four hours and affording elocutionary exercise for some twenty-five persons. Those who survived the dinner were

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* A Summary of Dr. Cramer's remarks will be found elsewhere in this issue.—[ED.]

entertained on Sunday afternoon by the R.M.S.P. Company to a steamboat trip to the islands near the Bocas, the floating dock, and other places in the Gulf. Refreshed by the interval the delegates showed a keen interest in Rubber, to which Monday morning was devoted, and the discussion which arose thereon was perhaps the most lively and informative of any during the Conference week. The Trinidad Agricultural and Industrial Exhibition was opened on the Monday afternoon, and to this the delegates were invited by the indefatigable organising secretary, Mr. Edgar Tripp. In the evening an illustrated lecture on "Rubber and Balata in British Guiana," prepared by Mr. Stockdale with slides by Mr. J. Williams of the Government Laboratory was given by the Science Lecturer, and by special request Dr. Cramer repeated his account of Rubber Cultivation in the East. The last day, Tuesday, saw a proposal brought forward for a West Indian Trade Commissioner in Canada and some timely advocacy of the Entomological Research Committee. This brought to a close an eventful week, rendered delightful by the hospitality of the inhabitants of Trinidad, from His Excellency the Governor downwards.

A Freak Plantain Bunch.

A plantain tree grown in the vicinity of Colombo has produced a record bunch of fruit. The tree itself is of the average size but the bunch of fruit is quite nine feet or more in length and resembles in shape the trunk of an elephant. The fruit cluster so thickly that the combs are hardly distinguishable, and the total number of plantains must be a thousand or more. The length of the fruit at the head of the bunch is about 3½ inches while the diminutive ones at the bottom are barely an inch long. The bunch is not mature yet and the flower is still on; the tree appears to have been cut in too great a hurry, due no doubt to the impatience of the native who is now exhibiting it somewhere in Maradana at the rate of 5 cts. per head. The owner avers the young trees was brought to Ceylon from the Far East but to all appearance it is a freak growth of the ordinary variety "*Musa Sapientum.*"

—"Tropical Agriculturist" (Ceylon) Oct., 1911.

Rubber Cultivation.

WHILE representing Surinam at the Agricultural Conference in Trinidad, Dr. P. J. Cramer, the Director of Agriculture in the Dutch Colony, gave a most interesting lecture on Rubber Cultivation in the East. It is well known that Dr. Cramer had a unique opportunity of studying the subject while travelling from Java to South America, and some idea of the use he made of this chance can be gathered from the hundred odd lantern slides he uses to illustrate his remarks when lecturing. British Guiana was fortunate in having Dr. Cramer as a visitor when he was returning to Surinam and in hearing his lecture at a meeting of the Royal Agricultural and Commercial Society held on February 19. The following summary of the lecture may interest our readers: we regret extremely we cannot reproduce the photographs.

THE first set of slides gave an idea of the opening work. The cutting of the wood and the further cleaning by burning and second burning was shown. Every attention must be paid, said the lecturer, to the opening, as there occurs a dangerous disease, caused by a fungus, living upon decaying wood as well as on the roots of the rubber trees. Therefore, if decaying wood is left in the soil, the root fungus may appear and attack the Para rubber, spreading through the whole field; if once present, a good deal of money has to be spent in cleaning the soil again and in treating the diseased trees. Views of the fungus itself and of methods to keep it under control were shown, and explained. Dr. Cramer said that up till now the root disease had not been found in this part of the world, but a well carried out, clean opening would always be to advantage of the rubber.

Discussing the different conditions of soil and climate Para rubber requires, Dr. Cramer said that Hevea prefers a low country climate to a high altitude above sea level. At about 2,000 feet the growth is poorer than on the lower land. If planted on hills, attention must be paid to avoid erosion; an example was shown of a tree, the roots of which were above the soil owing to the washing off of the top soil by rain. The original idea was that Hevea would like swampy soil; experience has shown that this is not the case, and that Para rubber requires well-drained soil; a depth of at least 3 feet is necessary. Views of plantations to show the drainage systems were put on the screen.

Coming to the raising of the planting material, attention was drawn to the occurrence of large variations in the growth of the trees. Sometimes exceptionally thick trees are found; an example of such a tree was shown, the lecturer pointing out that it is advisable to chose such trees as seed bearers.

The seeds, he continued, are left in wet sand or a similar material, and as soon as they germinate are put out in seedling beds. These may be shaded sometimes in the beginning; it is better to have them afterwards quite open. Unshaded beds give stronger, thicker and hardier plants than shaded ones. The most generally practised way of planting in the East is the planting of stumps. The laying out of the fields has to be done carefully. The trees must be planted in straight rows; this makes the upkeep in the first year easier and allows afterwards a better control of the tapping. In the fields a sufficiently developed road system is necessary; of course, a system of navigation trenches as might possibly be laid out here, is even preferable, as it enables an easy and safe transportation of the latex. Sometimes, in exposed places, windbelts are necessary, as Para rubber suffers a good deal from wind. A strip of the original wood may be left, or a special belt of some bushy tree may be planted.

METHODS OF PLANTING.

The planting was then explained: the planting of stumps, the bad result of not thinning out the new shoots of the stumps, and of leaving more than one stem on one root were illustrated. A view in a two-year old field showed the differences among the trees as to their tendency to branch. Formerly, the stems were often topped to stimulate branching; but, as was shown in a view of a 5-year old field, the result is that the trees get a candelabraform, the crown becomes too heavy, and branches often break off. It is therefore better to allow the end bud to grow on, and to stimulate the growing of the other buds into branches by taking off the top whorls of leaves.

Para rubber requires a good upkeep. It is a mistake to think that it can stand weeds and grass. In the East clean weeding is generally practised, as was shown in several slides. Sometimes, on flat, loose soil, a cultivator can be used. There is no doubt that clean weeding is the cheapest method of upkeep, if well carried out. The weeds are pulled out before they can form seeds and so after a time are practically cut out. In the East, the lalang, a hard, stiff grass, is particularly dangerous to the rubber fields

if the upkeep is neglected; it spreads quickly and the rubber trees are at first kept back and even die out. In older fields, weeds do less harm; but still, many full grown, tapped fields are kept up by clean weeding. But, what is possible in the East, is not always practicable here. For several reasons, clean weeding cannot be recommended for places like British and Dutch Guiana. Our soils are too stiff, so that it is impossible to pull out the weeds with the root; the part remaining in the soil soon sprouts again. Then our rubber trees do not form the same heavy crown as they do in the East; four or five year old trees of about the same girth as those in the East, have a far smaller, more open crown and do not shade the soil so thickly. And it cannot be thought safe to expose our soils to the bare sunlight. Therefore we must look for another system of upkeep, covering the soil by a special coverplant, or growing another crop between the rubber trees. A series of slides showed different kinds of leguminous cover plants as intercrops for rubber and attention was drawn to coffee and bananas, which were shown in several views. Crops like cassava and sugar cane, said Dr. Cramer, are not fit for growing among rubber, as they keep the rubber back.

The subject of tapping was illustrated by numerous slides, showing various tapping systems, the effect of bad tapping, the way of using different kinds of tapping knives and experiments with high tapping. The series closed with a photograph of an old rubber tree in Ceylon, which gave in 1909 a net profit of 23 guineas; but, said the lecturer wistfully, veterans like this, 33 years old when it was photographed, are rare.

The curing of the rubber was then dealt with, and views in the factory on a rubber estate, showing the coagulation of the latex, the rolling of the crépe and a drying house closed the lecture.

Impressions of The Rubber Exhibition.

THE second International Rubber Exhibition under the Presidency of Sir Henry Blake, G.C.M.G., was opened officially by the Rt. Hon. the Earl of Selborne, K.G., on June 26th in the Agricultural Hall, Islington.

The whole of the space of the Agricultural Hall was taken up by exhibitors, and practically every rubber-growing country (or better every country which can grow rubber successfully) and many rubber-growing companies were represented, whilst the manufacturing side of the rubber industry was also fully represented—especially from the Continent. The Exhibition was generally recognised as being an unqualified success, and the Conference on rubber matters held during the Exhibition was largely attended by those interested. The following brief notes on the Exhibition and the Conference indicate some of the matters that appeared to me to be of the greatest interest to the rubber interests of the colony :—

The Courts of Brazil, the Belgian Congo, the Netherlands (including Java, Sumatra and Dutch Guiana), Ceylon and Malaya were very fine and the exhibits were of excellent quality and effectively arranged. Very attractive exhibits were also made by Southern India, the Gold Coast, Trinidad and Tobago, Uganda, Mexico, and Peru, while the exhibits of this colony also commanded their share of attention.

In the Brazilian Court was exhibited 385 balls of hard-cure upper Amazon Para rubber and 91 balls of Caucho,—representing 1-1000th of the total export of rubber from Brazil. Needless to say, this attracted a great number of visitors, as also did the enlarged photographs descriptive of the methods employed in obtaining the rubber from the Brazilian forests. The differences between the different kinds of rubber exported from Brazil was also demonstrated. I was particularly interested in the fina Para rubber from the upper Trombetas and Yamuda which is obtained not from *Hevea brasiliensis* but from *Hevea Benthamiana*. Dr. Huber, the distinguished Director of the Museum Goldei and Botanical Garden of Para, was present as one of the Brazilian Commissioners, and he assured me that the quality of *H. Benthamiana* rubber was equal to any fine Para rubber produced from *H. brasiliensis*. What *H. brasiliensis* is to the low lands of the Brazilian foiests in the Upper Amazon distiict, *H. Benthamiana* is to the higher lands

but it was found to be unremunerative as the trees are slow growers and yield but sparsely when tapped in the usual way in their earlier stages of growth. It was found experimentally that a large quantity of gutta could be obtained by mechanical and chemical treatment of the leaves as they fell from the trees. A plant was put in to obtain this gutta and the product which was exhibited at this Exhibition was obtained from the fresh leaves. The gutta was very attractively blocked and attracted a good deal of attention. Opinion seemed to be divided as to the relative value of gutta prepared from the leaves, but it seems to have satisfactorily passed many severe mechanical and chemical tests for commercial purposes. Another exhibit in this Court that greatly interested visitors was a set of laboratory rubber machinery, consisting of washing machine, mixing machine, vulcanising press and vulcanising pan especially made for the Government Bureau for the rubber trade and industry at Delft by Messrs. David Bridge & Co. This formed a very compact plant and demonstrated the energy with which the Dutch Government is now attacking rubber problems.

The exhibits from Surinam I carefully went through. The Government exhibited plantation Para rubber, wild rubber from *Hevea guyanensis*, balata, photographs, etc., while two balata companies exhibited samples of balata, and other exhibits were made by the Colonial Museum at Haarlem. Some of the plantation Para rubber was of good quality and was carefully prepared. The wild rubber was clear and carefully prepared, but was weak and of low commercial value. A few of the balata samples appeared to be excellent, but many were old and discoloured. These old samples detracted from the general appearance of the balata exhibits from our neighbours.

Ceylon had a fine Court. A central building was erected to serve as office for the Ceylon delegates, and as reception-rooms, while the rubber samples were displayed along low tables extending upon the sides of the Court. The rubber exhibits made a very fine show. Exhibits were made from twenty-five estates and the quantity shown from each varied from 60 lb. to 600 lb. In these exhibits pale crêpe seemed to predominate although a considerable quantity of good sheet was on view. The various samples I carefully examined with the Ceylon delegates and was particularly interested in the smoked and non-smoked Para sheet, as well as in the different forms in which Para rubber is put up. Another very interesting exhibit on this stand was the trunk of a Hevea tree which had been lately tapped by a method that is being experimented with by Mr. Kelway Bamber, Government Chemist, Ceylon, at the Ceylon

Experimental Stations. It has only been under trial for one year, but the results obtained so far seem to indicate that very satisfactory returns may be obtained by this method with a greatly reduced number of labourers. This is of great interest to this and other West Indian Colonies where the cost of labour is relatively high. By this method no bark is excised, as it may be considered a modified incision method. The experiments in Ceylon with this method will be watched closely and it is hoped to commence similar experiments in this colony, as any method that will tend to reduce the labour requirements of the tapping period will be of the greatest importance to the rubber industry here.

The Malayan section was undoubtedly of great interest and equalled, even if it did not surpass, that of Ceylon, in attractiveness. In this section samples of Para rubber in various forms were exhibited by about thirty estates. Several estates sent only one or two samples, but one estate sent up to ten samples of rubber in various forms, and seeing that practically every sample weighed over 25 lbs., it is not necessary to say that a very effective display was made. Whereas it appeared to the visitor that crêpe rubber predominated in the Ceylon section, the Malayan Court seemed to have the greater number of samples of sheet rubber, smoked and unsmoked. The smoked sheet rubber was indeed very fine, and the uniformity of the samples in the Malayan Court was generally remarked upon. Now that the rubber market is beginning to take an interest in the possibility of standards for plantation rubber and is looking for greater uniformity in the plantation output, this general opinion on the Malayan exhibits was interesting. The general opinion appeared to favour sheet rubber, either smoked or unsmoked, or blanket crêpe and it was interesting to note that pale crêpe, which was favoured in the Ceylon Court, was not exhibited to such a large extent by the Malayan estates. Gutta-percha, rubber from Jungle creepers and the wood of Jelutông (*Dyera* spp.) was exhibited, as also were various forms of Rambong rubber (from *Ficus elastica*). I was interested in the native made tapping knives for gutta-percha exhibited by the Forestry Department of Perak, and I hope to get samples of them. The knife that seemed to be most favoured was an enlarged farriers-knife made after the rubber tapping knife fashion.

A separate counter was set aside for historical exhibits from Malaya. These consisted of Brazilian rubber taken to England by Mr. Collins in 1873, when he took the first rubber seed to England, the first trade biscuit of Para rubber made in Singapore in 1896, and a sample of the first cultivated rubber from Perak that

was sold in England in 1897. This sample was prepared by Mr. R. Derry, who was at one time attached to the Botanic Gardens in this colony. Some excellent samples of Para rubber were shown in the Court of Southern India and there were several fine sheets and biscuits of Ceara. The samples of rubber in the Court, however, were not in sufficient bulk to command as sufficient attention as they should have done and it was felt by many that the sheets and biscuits had in many instances been made too thin. Photographs, coffees, teas and timbers were also exhibited in this Court.

The Gold Coast exhibited commercial samples of the wild rubbers exported from that colony, and also specially prepared samples of *Hevea brasiliensis, Manihot Glaziovii, Ficus elastica, Funtumia elastica,* etc. Some of the samples of Para rubber were quite good, and it was understood that the cultivation of rubber in the Gold Coast was being undertaken by a number of European Companies. Herbarium material and seedlings of *Funtumia elastica* and *Hevea brasiliensis* were exhibited, as well as samples of cacao, palm oil, palm kernels, cola-nuts, etc. The statistical table showing the exports of cacao from the Gold Coast in recent years clearly demonstrated what can be done in a densely populated country with a new industry suited to the country by means of regular Government aid in the early stages of its establishment.

Uganda and British East Africa showed some interesting samples, and the Para and Ceara rubber exhibited at these Courts was inspected by a large number of people. Photographs and samples of other products produced by these colonies were also of interest.

The Trinidad and Tobago Court was attractively arranged, and the numerous samples of rubber exhibited showed that considerable activity has been and is being taken in rubber in that colony. Some of the samples of Para biscuits, although small, were of excellent quality. The Castilloa sheet prepared by Smith's centrifugal machine was of the greatest interest. This machine certainly turns out a very attractive product, and the valuation of the sheet exhibited was high. Demonstrations were given during the exhibition with this machine both with Castilloa latex and with Para latex. Considerable interest was awakened in the machine and it is possible that arrangements may be made for extensive trials in the East, as it is thought that if it can be used successfully for Hevea latex a considerable amount of time and labour can be saved in the production of sheet rubber for the market.

The exhibits in the British Guiana stall received their full share of attention. The fine sheets of balata exhibited by the Consolidated Rubber and Balata Company were universally admired and many people interested in balata commercially expressed the desire that all balata shipped should be of such good quality. Many enquiries were made in regard to balata in the colony and the possibility of obtaining leases, particularly from Americans. The sample of rubber exhibited from Pln. Noitgedacht was reported by many authorities to be of equal quality to any cultivated rubber prepared in biscuit form from the East. It was examined by a large number of people, and there were numerous enquiries as regards rubber cultivation in the colony. On the whole our Para rubber seemed to be tougher than that exhibited in the Ceylon and Malayan Courts, but did not seem to possess quite so great an amount of elasticity and resiliency. In the earlier years of the rubber industries tough and strong rubbers were generally sought after, but now there seems to be a decided movement towards valuing rubber finally on the vulcanization tests and not solely upon apparent physical properties. In this connection, it is of interest that many apparent soft rubbers vulcanize better than many of the tougher kinds, and it was also noted that the decision in regard to the "India Rubber Journal" competition for the best sample of Para rubber at the exhibition was only given after exhaustive vulcanization tests.

Enquiries were made in regard to methods of tapping, preparation of rubber and tapping tools, and additional information was gained. The majority of the patent tapping knives were condemned by practical planters. The machinery exhibits were excellent and a large amount of information as regards machinery and the manufacture of rubber was at hand. The practical demonstrations of coagulation with various chemicals were interesting and the demonstrations with different kinds of washers and with the preparation of Guyule rubber were large attended. I was particularly interested in the question of Guyule rubber and its extraction from the Guyule shrubs, as it seemed that it was possible that the solution of many points in regard to cultivated Sapium rubber in this colony lay in the adoption of similar methods.

The Conference meetings and lectures were attended as often as possible, and some interesting discussions were listened to. It is proposed that the deliberations at the Conference be published in book form, and it is possible that a review of the proceedings may be available for the next number of this *Journal.*

In conclusion it is only necessary to add that it was generally recognised that the exhibition surpassed all expectations. It was a purely technical exhibition, and everyone who visited was interested in one way or another. The planters of the East were greatly interested in the advances that the machinery side of the industry had taken, and the manufacturers and brokers gladly welcomed the practical planters. I was fortunate to make the acquaintance of many connected with the industry of the East and I consider myself fortunate to have been able to have obtained information at this exhibition which might have taken years to have acquired through pamphlets, etc.

It was made clear that we appear in this colony to be working upon right lines and the President, Sir Henry Blake, and others were greatly interested in the progress this and other West Indian colonies were making with rubber cultivation.

F. A. STOCKDALE.

Rice as a Muscle Builder.

A recent editorial in the "Lancet-Clinic" points out that the defeat of Russia by Japan drew the attention of the whole world to the power of endurance exhibited by the Japanese, and that much surprise was expressed that a rice-eating nation should develop such remarkable physical power. In the United States, as well as in Europe, rice has usually been considered an inferior food owing to the excess of starch in its composition, and this is undoubtedly true of the rice as we meet with it. But this defect in the grain is the result of the removal of nutrient matter for the purpose of making the rice more presentable for the market, by what is known as the polishing process. Not only is the outer husk taken off but what is called the "rice-meal," which envelops the inner kernels also is brushed away, although it is highly nutritious, being the albuminous portion of the grain.

It is, however, an unattractive brown in colour. This rice-meal is exported to Europe by rice-growing countries, and in England it is made into what is named oil-cake with which cattle are fattened. Chemical analysis of rice-meal shows that it contains about 12½ per cent. of albuminoids and 4½ per cent. of phosphoric acid, and the former appears to be easily digested by the human system.

As the Japanese, in common with the other rice-eating nations, do not polish the grain, they retain a large proportion of nutriment and flavour to which virtually all Americans and Europeans are absolute strangers.

—The Tropical Agriculturist" (Ceylon), Oct., 1911.

Lessons with Plants in British Guiana.

["*It is finding answers to questions which chiefly deserves to be called Science*"—L. C. Miall, F.R.S., in "Teaching and Organization."]

III.

THE FLAMBOYANT AND ITS FAMILY.

In this article we shall consider the Flamboyant. You can hardly mistake the tree; it is to be found in almost every street in Georgetown, and even when its brilliant scarlet blossoms are not to be seen its huge brown cutlass-like fruits hanging vertically amidst feathery foliage can hardly escape notice. Before examining details we must, of course, make a note of the habit of the tree for future reference; it is probable that on closer inspection we shall find some reason for the method of growth. We must spend some time, too, in examining the bark, observing whether this is thick or thin, smooth or rough, prickly or scaly, and whether it shows a tendency to strip off or crack or flake off; and by means of an incision with a sharp knife we may try to find out how deep it is and what lies between it and the wood. In most cases you will find that a valuable series of observations may be made on the flowering periods of the tree: does it flower when in full leaf; do you find ripe fruit, leaves and flowers all on the tree at the same time; do all the trees in your district flower at the same time; and if so does this time show any relation to the wet and dry seasons? If you make careful notes of these points during a whole year on a calendar you will probably find them both interesting and instructive.

COMPOUND LEAVES.

Now let us examine a branch in detail. Trace the alteration in the character of the bark as you pass from the base of the plant to the finer ends; note where the brown colour stops and the green begins; are there any of those little light raised "specks" to be seen which we noticed on the Hibiscus? Make a careful study of the leaf-scars which you will find on the branches, and try and confirm by your own observation the rule we have already arrived at that in the axis of a leaf a bud is usually found. Examine one of the leaves and compare it with a series of others. It is evidently much divided, and the first question which arises

is naturally, which is the real leaf? There is evidently a main axis starting from the branch and this bears smaller axes on each side of it and more or less at right angles to it (how many of these smaller axes are there, and is the number fairly constant over a large number of leaves?); these smaller axes bear tiny flat leaf-blades arranged regularly on each of their sides. (Count these and see if their number is constant and whether—allowing for those which may have fallen off—the number is odd or even, *i.e.*, whether the apex of each axis bears a single leaf-blade or not. If it does the total number of leaf-blades will be odd, if not the leaf-blades, being arranged in pairs, the total number will be even.) Now which is the true leaf; the ultimate divisions which are the small leaf-blades, the small axes with the small leaf-blades upon them, or the big axis with the small axes and the small leaf-blades? Let us apply our rule—*find the bud.* The bud will be in the axis of the leaf; break off the leaf at this point and everything you hold in your hand will be leaf. Look then for buds at the bases of the tiny leaf-blades, at the bases of the small axes, and at the junction of the main axis with the stem. We have already arrived at the idea of a compound leaf in which definite leaflets were borne on the midrib of the leaf; is it possible that the leaflets themselves may be compound, the blade of the leaflet being split up into secondary leaflets? Can the process go even further, so that we may get leaves which are once, twice or even three times compound?

ANOTHER POINT.

Your experiments with the ochroe will already have given you some idea of the importance of bright sunlight to green plants; it is clear that a feathery leaf such as that of the Flamboyant will not cast so heavy a shadow as a simple leaf of the same size; more light will find its way through to other leaves below and possibly this may be an advantage to the whole tree. Do not forget to note whether stipules are present on the Flamboyant leaf and, if so, what their shape and character is; and try and find out whether the leaflets also bear similar structures.

POINTS ON THE FLOWER.

Now examine a flowering branch, noting carefully whether the flowers are borne at the end of a branch or at the sides. The flowers are evidently in a cluster and not arranged singly as in the Hibiscus; and it will be of interest if we study the mode of branching of the cluster and the arrangement of flowers. Are the youngest flowers—the buds—at the apex of the branches or *vice versa*?

The flowers themselves are large and simple, and easy to examine and draw. Follow the directions given in the case of the Hibiscus and count and draw everything minutely. Are all the petals alike in shape and colour? If not, make a careful note of those which differ from the others. Note too the relation of the differently coloured petal or petals to the position of the flower on the branch. Study the stamens in a flower which has just opened, find the pistil with its stigma, style and ovary, and examine very carefully the place where the "claws" of the petals meet. Break off each petal and examine the point of fracture with the greatest attention; you will probably find an arrangement of great interest. You will remember the nectary of the Hibiscus with its sweet juice which was evidently an attraction to insects; in the Flamboyant the arrangement is different. This can be discovered on careful examination, and sketches to explain its mechanism should be made. We may have come across here an example of those modifications of flowers which seems to serve the special purpose of pollination, but the details can only be found out by long and painstaking observation. One is apt to jump at conclusions in these cases, misled very often by what one has read in books, and in some cases unfortunately imagination takes the place of observation. The following is an example of the kind of study which is desirable in the case of the Flamboyant flower before one can understand the object of its mechanism; and remember always that it is not necessary to know the names of visiting insects or birds in order to study their habits and their relation to plants. If you happen to know their names well and good; if not label them A. B. or C, X. Y. or Z; call them any names you like so long as you always keep the same name for the same animal; and leave the real name to a more convenient season—going on meanwhile with your observations. The name is the last thing you need know about anything. With this hint you can read with profit the following notes: and having read them endeavour to apply the method to the plants before you.

THE POLLINATION OF THE PRIMROSE.*

"The chief insects seen visiting the flowers (Primroses) were species of short-tongued burrowing-bees (*Andrena*), hive-bees (*Apis*), small humble-bees (*Anthophora*), large humble-bees (*Bombus*) and a fly called *Bombylius*. Considering the regularity of the visits of *Bombylius* and the relatively large number observed in really fine weather, I have no doubt that this insect is an active agent

* This extract is from a paper by Prof. Weiss (New Phytologist, 1903) and is quoted from "The Senior Botany" by Dr. F. Cavers.

in the pollination of the Primrose. It seems admirably adapted to obtain nectar from the depths of the tubular corolla with its long proboscis, and it seemed at this time of year to confine its attention to the Primrose. Only on one occasion did I observe a *Bombylius* sucking nectar from the Celandine, which is so largely visited by the bees. . . .

"On five different occasions I have observed *Bombus* visit Primroses, and generally in such a manner as to ensure the pollination of the flowers. In two cases, however, I noticed the humble-bee not sucking at the flower, but moving all over the corolla apparently endeavouring to obtain the honey by illegitimate means, just as Darwin observed them at times biting through the corolla in the case of the Cowslip, of which they are regular visitors. I ought to state clearly that *Bombus* was a more frequent visitor of other flowers than the Primrose, and was more commonly seen on the Willow, the Dandelion, the Violet, and the Barren Strawberry. A smaller humble-bee, however (*Anthophora*), though less plentiful in the district, was more often seen on the Primrose, to which it seemed to confine its attention. There can be no doubt that this insect is both able to gather honey from the Primrose flower and also to effect its pollination.

"The honey-bee (*Apis mellifica*) appeared to be less hardy than the humble-bee or *Bombylius*, for it only gathered honey on warm days and was not observed at all on several days when *Bombylius*, *Bombus*, and *Anthophora* were about. The bees visited chiefly the Celandine, Barren Strawberry, Wood Anemone, Violet and Dandelion. Occasionally a stray one would visit a number of Primroses, but did not spend much time on each. They were evidently endeavouring to obtain the nectar, which however they were unable to reach. They stayed a little longer on the short-styled flowers, from which they collected a little pollen. They were obviously not the regular visitors of the flowers, although they could no doubt bring about cross-fertilisation of the long-styled forms.

"This object would also be effected by the visits of *Andrena gwynana*, but this insect must be placed in a different category from the bee, for it is a regular and busy visitor of the Primrose and more often seen by me on its flowers than on those of other plants. It was only observed towards the close of my visit when the weather was much milder, but then it was present in considerable numbers. It gathered the pollen greedily and in getting at it poked its head deep into the mouth of the corolla.

"From the instances given above, therefore, there is no doubt in my mind that Primroses are efficiently cross-pollinated in the district under observation by *Bombylius*, *Anthophora*, and *Andrena* with the addition of occasional though by no means isolated visit of *Bombus*.

"That self-pollination may occur fairly often in the Primrose cannot be denied, and, indeed, Darwin observed the frequent occurrence in both Cowslip and Primrose of *Thrips*, which he considered aided the self-fertilisation of both forms. In many primroses which I examined numbers of *Thrips* were present, and in these flowers it was very common to find pollen grains scattered throughout the tube of the corolla and it seemed likely that it had been carried about there by these small insects. Another agency for self-pollination is no doubt the wind, taken in conjunction with alterations in the position of the flower.

"In the absence of cross-pollination, which must frequently fail in flowering plants in early spring, the strong winds of that season are probably of considerable use. In the Primrose the flowers open at first in a vertical position, and if the flower is short-styled the pollen from the opening anthers can readily be shaken by the wind on to the lower-standing stigma. But towards the end of flowering the flower-stalk has grown considerably in length and the flower passes into a horizontal and often a pendant position, so that the long-styled forms have a chance of self-pollination too when the flowers are agitated by the wind.

"It may be thought that this movement is mainly for the concealment of the fruits, which in the Primrose are ripened beneath the foliage, but though this may be to a certain extent the case I cannot but believe that the self-pollination is also a determining factor in this movement. For in the Cowslip the very opposite occurs. The flowers, at first pendant, offer greater facilities as far as self-pollination is concerned to the long-styled forms, but later on the flowers become erect and thus in the absence of cross-pollination the short-styled forms will have ample opportunity to be self-pollinated.

"From the observations I have made on the Primrose I feel convinced that it is both regularly visited and cross-pollinated by insects under favourable climatic conditions, but that like most flowers adapted to the visits of insects it is provided with efficient means for self-pollination, and these are important to a plant flowering at so early a period of the year, when the visits of insects may be precarious."

POLLINATION IN THE *Hibiscus Cannabinus*.*

"A study of the methods of pollination in this crop (*Hibuscus Cannabinus*) showed that the opportunities for cross-pollination by insects are very great.

The flowers of this species open in the early morning before daybreak and begin to close about midday. The closing of the flower is fairly rapid and before sunset the partially withered corollas are twisted up. During the night still further twisting of the corolla takes place, giving rise to a cottage-loaf shape of the withered flower.

The method of pollination of the flowers of this species is of considerable interest and does not seem to have been previously studied in detail. When the flowers open, the stigmas are at the mouth of the staminal columns and the anthers have not yet commenced to burst. Soon after daybreak, the stigmas still remain flush with the opening of the column. After this the turgidity of the filaments falls off and the burst anthers bend back towards the column. Simultaneously the styles elongate and carry the stigmas into the air beyond the opening of the column and at this stage pollen grains are rarely seen on the stigmas. Sometimes, however, the styles bend outwards and carry the stigmas on to the pollen, thus bringing about self-pollination. Frequently no pollen is seen on the stigmas when the flowers begin to close about midday. If closed flowers, however, are opened carefully it is found they are always well pollinated. Self-pollination is effected almost entirely by the closing of the corolla. The limb of the petal is thin, the claw very thick. The corolla closes by the falling towards the centre and twisting of the thin limbs. This brings the corolla in contact with the burst anthers and the completion of the closing of the flowers covers the stigmas with pollen.

It will be seen that the flowers are adapted both for cross and self-pollination. From the time the styles begin to carry the stigma beyond the opening of the column to the closing of the flower crossing is possible. Self-pollination, however, may also occur during this period. A sufficient supply of seed is ensured by the very effective method of selfing when the flower closes.

The flowers of this species do not set seed under bag in the ordinary way unless artificially self-pollinated. This is due to the fact that the flowers do not close normally in the bag. The thin limbs of the corolla do not fall together and twist in the usual manner, possibly on account of the even humidity of the air both outside and within the closing corolla."—(*To be continued*).

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* Albert Howard and Gabrielle Howard in "Memoirs of the Department of Agriculture in India": Vol. IV., No. 2 August, 1911.

Infant Mortality.

THE *consideration of infant mortality and its prevention* may seem to be scarcely within the province of an agricultural journal, and yet the saving of infant life is perhaps the most important of all problems in this as in other colonies. The great cry, in British Guiana, is "Give us population," as our present average of 3.27 persons to the square mile is totally insufficient for the development of any resources which the country may possess.

How is this deficit to be met? The immigration of indentured coolies, the importation of foreign labourers for the construction of a railway, in the hope that when the work is finished these will become permanent settlers, the inducements offered to West India Islanders or to the native adult population, to take up and develop land—all these means are before us. Each has certain disadvantages; immigration is expensive, and East Indians cannot be indentured for more than a few years, take some time to become acclimatized and when they have been in the colony long enough to save money, are prone to return with their money to their native land, leaving British Guiana no better off for population than before their advent.

West India Islanders might settle here, but from these Islands no such numbers as this colony needs, can be sent. The present adult town population, while it can support itself, or be supported, in the town, does not care to take up land in the interior; the memory of the days of slavery, when the black had perforce to work on the land, is still recent enough to give him a distaste for agricultural pursuits.

There is still, however, a source of supply, in the younger generations, present and future, of the native, who can be educated to agricultural usefulness, and over whom the idea that work on the land is a return to slavery, has little hold.

It may seem absurd to call upon a generation yet unborn for colonisation, but it seems yet more absurd to waste annually thousands of lives, and to try to fill their places by expensive importation from other countries.

In the Surgeon General's Report for 1910-1911, it is noted with regret that infant mortality is extremely high, 235 per 1,000 births, while the birth-rate has decreased from 32.9 per cent. in 1906 to 27.5 in 1910. Some improvement had even then taken place, for in the year 1907, there had been 256 infant deaths per 1,000 births, that is, slightly over one-quarter of the infants born were des-

tined not to survive. The mean rate for the past five years has been 210 per 1,000 births.

Were these lives saved, we should have a very much increased population, already acclimatized, whose training as useful colonists would be in our own hands.

Decrease in birth-rate seems to be a concomitant of increased civilisation, due probably to the increased strain and cost of living, and the later age for marriage, but we could at least, in common with all other countries suffering under the same disability, take steps to preserve the children already born.

The country starts well equipped for the preservation of child life, as it is particularly free from those epidemics which cause havoc amongst the children in temperate climates. In England and Wales in 1908 there were 1,616 deaths of children under 5 from scarlet fever, and 2,827 from diphtheria, while British Guiana, in a total of over 18,000 cases of all ages treated at the various Public Hospitals, had no case of the former, and only 3 deaths from the latter disease. We have reason to congratulate ourselves also on our complete freedom from the scourges of yellow fever, plague, and small-pox, in spite of their frequent occurrence in our neighbourhood.

Measle and whooping cough are more common, and often fatal, not so much by the diseases themselves, as by their sequelæ, bronchitis and pneumonia, against which both children and adults of the colony seem to have but little resisting power.

The special tropical diseases of malaria and filaria, of course, are rife, and it must be remembered, are very much more fatal to children than to adults, but the returns from the estates, where quinine is given regularly to the children, show such a rapid decrease in the occurrence of infantile convulsions and death, that it is obvious the remedy, for malaria at least, lies in our own hands.

Wasting and diarrhœal diseases account, as in temperate climates, for the greatest number of infant deaths, and these are due, in almost every case, to errors in diet.

On the whole, then, we may put down our high rate of infant mortality to diseases of the chest, disease due to improper feeding, and the mosquito-borne fevers.

All these are remediable, and one would like to see more attention paid to their remedy.

The colony is slowly, but it is to be hoped, surely, coming to the conclusion that the mosquito is not the harmless household pet it seems to have been formerly considered, but that it is a case of "Mosquito or Man ?" One must be driven out to make room for the other for both cannot live together in peace and amity.

Diseases of the chest, and diseases due to improper feeding, can be combated only by attacking their common causes, ignorance and apathy. Granted that in a climate like ours, with a heavy rainfall, and much inhabited land covered, for long periods of the year, with water, chills and colds are common, yet there are few days, even during the rainiest months, when we have not a supply of their best cure, sunshine. Our equable temperature is also one of the best preventives of serious chest trouble, therefore it lies in the hands of the people to use these natural advantages to the utmost.

The old fear of 'night air' and the consequent closing of all doors, windows, and even key holes, at night, is responsible for more 'chill' and 'fever' than is any climatic condition, and it is only by patient oft-repeated teaching, by precept and by example, that this superstition can be made a thing of the past. There are apparently no colony regulations against overcrowding, and it is perhaps hardly to be expected that landlords will be philanthropists, but the nearer the approximation between air inside rooms and that outside, both day and night, the less will be the liability to chest disease, more especially amongst children, who require a larger intake of fresh air than adults, even in health, as is shown by their quicker rate of breathing.

The feeding of infants and children, always a difficult problem, is rendered more so in a country where carbohydrates, in the form of plantains, yams, and 'pap' is the staple diet of the poor, to the almost total exclusion of the proteid and fat so indispensable to healthy growth.

The milk of the colony is possibly of good quality as it comes from the cow, though the watery nature of the pasture inclines one to the belief that it cannot be rich in fats, but it is expensive, and by the time it has passed through the many dirty and ignorant hands which lie between the cow and the consumer, it is little better than—as it has been called in one report—"liquid sewage," totally unfit for consumption by even a healthy child. It is to be hoped that some steps will be taken to enforce the existing excellent regulations, and that a pure milk supply will at some future date be obtainable.

It may then be possible to arrange, as in other countries, for the distribution of this pure milk to infants, either by some form of

State-aided milk dispensary, as an adjunct to the work of ·he soup-kitchen, or by special charities.

To deal satisfactorily with child health as a whole, wider means must be adopted, and the people in general must be educated in personal hygiene, more especially those who have the control of home conditions, the mothers.

The supply in country districts of hospital-trained midwives is a most excellent thing, and will, it is to be hoped, be rapidly increased—this at all events gives a good start in life to the children, the only disadvantage being that the good influence is exercised for a short time only after birth.

In English towns much has been done by the appointment of trained Health Visitors, part of whose duty is to visit homes from which notification of births have been received, and to give advice to the mothers upon infant feeding and rearing. The improvement in many consumptive homes here since the appointment by the Anti-Tuberculosis Society of a visitor, seems to show that extended work of this sort would be successful, and appreciated by the public.

Medical inspection of school-children, now almost universal in the United Kingdom, provides for a careful note of children's progress but opens up a vista of hospital clinics, dental and ophthalmic treatment, with which this colony could hardly as yet deal satisfactorily.

The Women's Imperial Health Association of Great Britain is doing perhaps more far-reaching work than any other health society. One of the aims of this Association is to arrange health lectures for women on such subjects as feeding and rearing of children, care of the teeth, dust and disease, value of open air, etc. Lectures are given in provincial towns and villages, in very simple language, and illustrated where possible by lantern slides, and these have met with a cordial reception amongst even the poorest and least educated.

Would it not be possible, in the town and country districts of our colony, to have some simple and practical talks to women ? Health lectures given in town, in connection with the various guilds, Unions, etc., are attended chiefly by men, and are of a more or less scientific nature, apt to be ' over the head ' of the average mother here. The talks we want should not be highly scientific or technical, but should be given by simple and practical people, and merely directed to impressing upon the mothers, present and future, of the colony, the value of fresh air, of good milk, of freedom from dust, and the simple

hygienic measures that every European mother has at least an opportunity of learning. Any teaching to be of value here must be extremely simple, and often repeated ; the work would be tedious, but it would be well worth doing if it would in any way help to stem the tide of infant disease and death, and to prevent the loss to the colony of what it so much needs, and on what the estates and agricultural industries have to spend so much—population.

MRS. MINETT, M.B., B.S.

A Model Abattoir.

Much interest was taken in the model of a slaughter-house, placed in the Departmental Court, by Mr. J. F. Chalk, slaughter-house inspector at Maryborough.

This miniature abattoir consists of a large galvanised iron shed, the floor of which is concreted and used for the dressing of stock. At the back are three crushes divided by four sliding gates, the centre one being used as a pithing pen. In this pen a mechanical contrivance has been placed whereby, after the animal has been pithed, a lever is pulled in the dressing shed and the carcass is thrown out for the purpose of dressing. The yards are hexagonal in shape, two sides of the hexagon being extended to meet the crush, thus making a small yard adjoining the crushes, and they are placed at each end of the crushes. One is used as receiving yard, and the other as an auxiliary yard, the floors of both being concreted. The cattle are placed in the receiving-yard, and a small gate is opened whereby they enter the small yard adjoining the crushes. The crush gates are then opened, the cattle enter, and particular beast can be picked out at will and the others passed on to the auxiliary yard. The cattle in the auxiliary yard can then be returned, and again any particular animal picked out and slaughtered. The sides of the yards facing the slaughter-house are screened, thus preventing cattle awaiting slaughter witnessing the slaughtering and dressing operations. The features to be observed are : Freedom from molestation and excitement, prevention of bruising, the choice of slaughter of any animal or animals, freedom from dust, and the saving of cattle from bruising by horning.

"The Queensland Agricultural Journal."
September. 1911.

The Biological Aspect of Soil Fertility.

In the past the fertility of a soil has been to a large extent measured by the examination of its chemical constituents and of its physical constitution. The chemical examination gives much valuable information as to the quantities of plant food present while the physical examination gives an idea as to the texture of the soil—an important factor in the production of a satisfactory crop. These, however, give but a partial knowledge of the true factors governing fertility, and it is only in later times that the biological aspect has received attention. Pasteur in 1862 first drew attention to the significance of certain bacteria in the soil while the later researches of Warrington, Winogradsky and Messrs. Russell and Hutchinson have shown how very important is the part played by these minute organisms in soil fertility.

The average soil contains bacteria which for present purposes may be classed as being 1. Beneficial, 2. Detrimental, and the object of this article is to show the importance of their presence and how cultural conditions may bring about the majority or minority of either of these classes.

Nitrogen, as is well known, is one of those elements essential for plant growth, and the beneficial bacteria are chiefly those instrumental in bringing about nitrification, that is to say the manufacture from decaying vegetable matter of nitrogen in a form readily available for plant food. Many species of bacteria exist capable of liberating the nitrogen present in decaying vegetable matter as ammonia—the most active known type being that known as *Bacillus mycoides*. The ammonia thus liberated is acted on by another organism termed *Nitrosmonas europea* which changes it into nitrate and becomes available as plant food by a species known as *Nitrobacter.*

Other bacterial forms exist capable of bringing the nitrogen present in the atmosphere into combination as organic compounds. The best known of these is the *Azobacter croococcum*, which is present in all soils—even in sand. They feed on the carbohydrate material present and also on vegetable matter. The oxidation of these gives them sufficient energy to fix the nitrogen. The extraordinary fertility of virgin soils has been explained in this way.

Again, other forms of bacteria are present in the soil capable of breaking up organic matter, humus, etc., though not producing nitro-

gen compounds at the same time. They reduce the organic matter to a suitable condition so that it may readily be attacked by the nitrifying bacteria. For the healthy and flourishing growth of beneficial soil bacteria several conditions must be fulfilled. There must be an adequate supply of oxygen, that is to say the soil must be well aërated. The requisite amount of moisture must be present, the soil must not be too dry or too wet, for under either conditions nitrification entirely ceases. The temperature of the soil must be such as to favour bacterial growth; 0° C.—55° C. are the minimum and maximum temperatures, 36° C. the most favourable. Temperature, of course, is to a very large extent dependent on moisture and aëration. A base must also be present or at least a substance (such as calcium carbonate) with which the acids, the products of nitrification, may combine. Bacterial activity ceases in the presence of extreme alkalinity or acidity.

DENITRIFICATION.

The detrimental bacteria are those which are capable of bringing about denitrification or, in other words, the complete loss of the nitrogen from nitrates in the form of gas such as nitrogen itself, oxides of nitrogen or ammonia. These bacteria are dependant on a sufficiency of oxygen for their growth. If, however, this necessary oxygen is denied them they will attack any nitrates present in the soil using the oxygen and liberating the nitrogen in the manner described above. Mention may also be made here of certain large organisms—protozoa and so on—present in soils. These prey on bacteria, and owing to their comparative great size (1,000 times larger than soil bacteria) act as a very severe check on bacterial activity.

Thus it will be seen that the conditions necessary for the growth of beneficial bacteria depend entirely on the various cultural practices carried out by the farmer. Regular neglect of any of these means a diminution of nitrification and in some instances a state of denitrification.

For the necessary supply of oxygen the soil must be well aërated either by ploughing or its equivalent. The drainage of the soil must be efficient, and a system of irrigation is necessary so that in the dry weather moisture may always be present. Aëration is also dependant upon a proper regulation of the water supply. Food in the shape of vegetable matter must be present. It may be mentioned here how important in this respect is the burying of trash in the canefields. By this practice the bacteria are provided with material which they

eventually turn into plant food, thereby increasing the fertility of the soil. Also the nitrogen-fixing organisms previously mentioned are provided for. With an increased number of nitrifying bacteria, the ammonium sulphate usually applied as an artificial manure is more quickly oxidised and rendered available as plant food. Finally, by the burying of this vegetable matter, the soil is kept open, allowing of a proper regulation of moisture, and distribution of oxygen. Neglect of this practice must mean an almost entire cessation of bacterial activity and an impoverished condition of the soil.

G. E. BODKIN.

Health in the Gambia.

A general improvement in this colony calls attention to the precautions taken. It is said that the practice of sleeping in mosquito-proof rooms or under mosquito curtains is not only invariable among the Europeans, but is being adopted by some of the more educated natives. All Government officials are provided with mosquito-proof cubicles and also with separate mosquito-proof shelters, in which they can sit and work or read during the day. This latter provision is probably the cause of the smaller number of days spent by European officials on the sick list on account of malaria during the past year and of the general improvement in their health.

"Medical Notes" in the "Colonial Office Journal." Oct., 1911.

Prevention of Malaria in Rice-Growing Districts.

The Journal of the Royal Society of Arts states that as a remedy for malaria in the rice-growing districts bordering on the Po, the rearing of fish is said to have given good results. This region, which covers an area of about 200,000 hectares (nearly half a million acres), is more or less unhealthy. The young carp are turned out into the flooded fields towards the end of June, and greedily devour the larvæ of the insect life which appear to be a cause of the disease. The cost of the young fish does not exceed four or five francs per hectare (1s. 4d. to 1s. 9d. per acre). It is stated also that the crops are improved by the rearing of the carp to the extent of four to five quintals of rice per hectare (two to two-and-a-half cwts. per acre).

"Medical Notes" in the "Colonial Office Journal." Oct., 1911.

The Nitrogen Cycle as it Affects Agriculture.

THE continued growth of plants and animals is dependent on many conditions, but one of the vital factors governing their development is the provision of nitrogen for their use in such a form as best suits the requirements of the several organisms. The important question of nitrogen supply for the use of growing crops on the farm is one that does not receive sufficient attention by the majority of agriculturists, and it is in this article proposed to endeavour, to indicate the changes which nitrogenous compounds undergo under certain conditions, the natural process by which plants and animals obtain this absolutely necessary element for their growth, the losses which occur, and the best methods of conserving and adding to the nitrogen supplies of the farm.

As is well known, nitrogen constitutes roughly about three-quarters, by volume, of the atmosphere, but, being an inert gas it does not readily enter into combination with other elements, and conversely, and for the same reason, it is easily liberated from compounds containing it. Hence, the ultimate tendency of nitrogen in combination is for it to be set free as gaseous nitrogen in which form it is not readily available to ordinary plants and animal life.

Now we have the two important facts, that nitrogen is an extremely valuable plant food; and, at the same time, it is easily rendered unavailable so far as its usefulness as food to ordinary plants or animals is concerned. Recognising both of these facts, it becomes a question of no little moment to the farmer as to how he may best prevent the loss of an element in the absence of which his crops will not come to maturity; but, before considering how losses may best be prevented, we must first consider the changes which nitrogen compounds undergo in the nitrogen cycle, and the chief conditions which lead to the loss of this element.

NATURAL CHANGES.

We may take, as a starting point, the nitrogenous vegetable compounds, that is, nitrogen contained as compounds in plants. When these are devoured by animals as food, they are converted, by digestion and change in the animal body, into nitrogenous animal compounds. Within the animal organism, continuous building up and breaking down of the tissues of the body is taking place, and in the latter process nitrogen becomes a waste product and is thrown out of the body in the liquid excrement in the form of urea.

This urea is an interesting compound from many points of view, but its chief interest to the farmer centres in the fact that it is very easily converted by certain bacteria and ferments into ammonia, and it is here where a great deal of the loss of nitrogen from farmyard manure occurs. The marked smell of ammonia noticed in an ill-ventilated stable is due to the decomposition of urea resulting in the formation of free ammonia, and this ammonia being volatile is practically lost to the farmer as a manure, as it becomes dissipated into the air and so is lost. Certain species of nitrifying bacteria, however, are capable under certain conditions such as free aëration, absence of light and presence of a slightly alkaline medium, of converting ammonia into nitrous acid which forms nitrites with such substances as lime present in the medium in which the bacteria are working.

THE FIXING OF NITROGEN.

Hence, if the manure containing the urea is properly looked after and subsequently applied to the soil, the nitrogen in the ammonia formed from the decomposition of the urea is fixed in the form of nitrites. These nitrites are not available to plants as food, but are converted by still other bacteria, working also under a certain set of conditions, into nitrates, and it is in this form that nitrogen is assimilated by plants. It must be remembered, however, that these changes from ammonia to nitrites, and nitrites to nitrates, take place to the fullest extent only under favourable conditions, and if the soil be water-logged, sour, and uncultivated, the reverse actions may be brought about by denitrifying bacteria, and the nitrogen will be lost.

The nitrogen cycle does not of necessity include the stage through the animal kingdom, for nitrogenous vegetable matter decaying in the soil is acted on by the nitrifying bacteria. It is converted into nitrites, and later into nitrates, whence it is again available to plants, and the cycle completed. Another cycle is completed when the nitrogen, set free into the air when vegetable matter is burned, is returned to the vegetable kingdom again by that class of plants known as the legumes, which, acting in symbiosis with certain forms of bacteria, have the power of fixing atmospheric nitrogen for their own use as food.

HOW NITROGEN IS LOST.

As stated above, the burning of vegetable matter leads to the nitrogen contained in it being set free into the air, and the same result takes place from the combustion of animal matter, or when

ammonia or its compounds are heated to a high temperature. It is to this practice of burning and the non-conservation of manures that the main loss of nitrogen that takes place on a farm, is due. For instance, when stubble is burned off, timber cleared and burnt, or vegetable matter allowed to decompose with free access of air and direct exposure to the weather, the most valuable constituent, *i..e*, the nitrogen, is lost in the ammonia formed during the decomposition process. It will be easily recognised that the amount of nitrogen dissipated into the air by the above actions is something considerable; and, if it were not for a provision of Nature, our soils would much sooner lose their fertility.

MEANS WHEREBY NITROGEN MAY BE REGAINED AND CONSERVED.

It has already been mentioned that Nature has endowed a certain class of plants with the ability to use atmospheric nitrogen for their requirements. It is almost entirely for this reason that the farmer, when he green manures his land, chooses, wherever practicable, all leguminous (pod-bearing) plant for his purpose. He knows that in this way he has a cheap method of providing necessary food for other crops which have not been endowed with this power of supplying their requirements from the air. Another means whereby atmospheric nitrogen is fixed, is the formation of small quantities of nitric acid during the electric discharges of a thunderstorm. The acid so formed is washed down in the rain and readily becomes available to the plant. It is doubtful, however, whether the above two natural provisions account for the returning into combination of as large a quantity of nitrogen as is set free. In any case the world at present depends for its supply of easily available nitrates mainly on the deposits in South America; and, for its ammonia supply, on the waste products of coal gas manufacture. The nitrate deposits in Chili must in time run out, and the demand at the present day for nitrates in the manufacture of explosives has put almost a prohibitive price on them as manure for crops, except perhaps where intense culture is carried on.

Many attempts have been made by chemists to fix atmospheric nitrogen for use as manure, and for manufacturing purposes; but, owing to its inert nature, fixation is very difficult, and scientific research has not so far led to the discovery of any cheap process. It would thus appear probable that the world would sooner or later be faced with a nitrogen famine if it were not for the consideration that scientists may be trusted to eventually devise some cheap

means for the fixation of atmospheric nitrogen. Already considerable quantities of calcium nitrate and cyanide are being made artificially by abstraction of the atmospheric nitrogen by means of electricity, and the resultant products have yielded satisfactory returns.

THE PREVENTION OF WASTE.

Nature always exacts some penalty for waste, and the agriculturist who wilfully neglects his nitrogen supplies will sooner or later find his land impoverished and himself involved in considerable financial outlay in bringing it back to fertility. His efforts in maintaining fertility should therefore be directed to the growing of leguminous green crops, either as fodder or as green manure, and to the careful conversion of his bulk manures. Farmyard manures instead of being allowed to rot in the weather, should be pitted and a small amount of some material, such as gypsum, added.

Special attention needs to be directed to the liquid excrements, as they are of much greater nitrogen value than the solids ; and, if possible, they should be collected in a tank or other receptacle. If they are to be used immediately, dilution with an equal quantity of water is advisable and a little superphosphate may be added, as the urine of grass-eating animals is deficient in phosphates. It is advisable, however, to use some of the liquid excrements along with the solids in the rotting process in the pit. In fact, the whole may be used in this way if sufficient bulky material, such as straw, etc., be present.

In this way, large quantities of valuable manure may be prepared and, as the value of the addition of farmyard manure to the majority of soils is well recognized, its utilization need not be further advocated here. What needs to be emphasized is the fact that valuable plant food is being continually lost from the majority of farms, mainly through neglect. If the farm is to be carried on as a business proposition, and to be worked in a businesslike way, then the owner will have to do his best to see that these losses are reduced to a minimum.—E. S. Holmes (Assistant to Chief Inspector of Farm Produce) in "The Journal of the Department of Agriculture of Victoria" (Australia), Oct., 1911.

The Application of Lime in Agricultural Practice.

WITH PARTICULAR REFERENCE TO PARA RUBBER TREES.

CONSIDERABLE interest is now being taken by planters in the Federated Malay States in the subject of manuring and requests for soil analyses and advice *re* manuring are being constantly received by the Department of Agriculture, F.M.S.

A number of enquiries has been received asking particularly for advice *re* lime, its method of application, and the benefits to be derived from it, in consequence of which it has been thought advisable to publish this article, which, although it makes no claim to originality, it is hoped will explain the value of lime as a factor in agriculture.

SOILS OF THE FEDERATED MALAY STATES.

In general it may be stated that soils in this country are deficient in the essential mineral constituents, *viz.*, lime, phosphates and potash, and as a rule contain fairly large quantities of nitrogen especially where the land has previously been under virgin jungle.

The deficiency in lime or calcium salts is particularly marked and is greatest in the peat formations of the coast overlying clay subsoils.

As is well-known, the peaty soils are very sour or acid in character when first opened out and the drainage water remains acid for months or even years after such lands are first opened out for cultivation.

THE ADVANTAGES OF LIMING.

(*a*). *Peaty Lands*:—In earlier days of agricultural practice in Europe, peaty lands were first opened out by through drainage, to carry off the excess of water and to aerate and dry the soils.

The surface was then broken up by ploughs and the earth heaped together and burnt, the combustion being allowed to proceed slowly. In this way the mineral constituents were increased proportionately and the acidity of the soil was neutralised by the alkaline ashes—chiefly carbonates of the alkalis (soda and potash) formed by burning the organic salts of these substances.

The great disadvantage of such a process is the loss of nitrogen in the organic matter of the soil.

This method has now been replaced by thorough drainage of land in such cases, the land after drainage being allowed to remain for some considerable time, in order to become consolidated, since, as is well known, and can be easily observed in the peaty soils in our coast districts, considerable shrinkage takes place when such land is opened out, and the land frequently sinks a foot or even more in many cases. The soil is then thoroughly limed to neutralise any acidity and to render the essential constituents more available for the plants subsequently cultivated on the land. To show the effect of lime on peaty land it is only necessary to collect the dark brown peaty drainage water and add to it a little lime water or solid lime—when, on standing for about 5-10 minutes, the whole of the organic matter is precipitated and a clear colourless water left.

(*b*). *Clay Lands*:—Clay soils were originally improved in a similar way, the clay after ploughing being heaped together with organic debris and slowly burnt at a low temperature. The physical texture of clay soils is improved in this way. The same disadvantages in the application of this method to clay soils exists as in the case of peaty soils, *i.e.*, loss of organic nitrogen. In addition to the advantages of improved physical texture in both cases, there is no doubt, in the light of recent discoveries, that the well-known effect of this burning was partly due to the partial sterilization of the soils which subsequently increased the bacterial flora.

This no doubt occurs to a considerable extent when virgin jungle is felled and burnt in countries such as the Federated Malay States, as, although probably in some parts the beneficial and other bacteria are completely killed by the high temperature on the surface the temperature at a depth of, say, one foot would be only sufficient to partially sterilize the soil and thus give rise to the benefits of such a process. Clay soils are improved to a remarkable extent by liming—the effect being principally an improvement of the texture of the soil.

The finer soil particles are coalesced by the addition of lime and lime salts and become flocculated into large particles, so that such soils after treatment become more open in texture and retain less water, which is often a desideratum in this country, particularly in flat low-lying lands.

A simple experiment can be easily carried out to demonstrate this flocculating effect of lime on colloidal clay particles. Two tall glass cylinders are taken and in a separate vessel a mixture of clay and water is made. The supernatant liquid from this mixture is then decanted into the two cylinders—the liquid contains only the finest clay particles which remain suspended in the water, for the most part for an indefinite length of time. If a trace of lime, slaked or quicklime or a solution of lime water be added to one of the cylinders, the whole of the clay particles suspended in the cylinder will quickly fall as a sediment to the bottom of the liquid leaving a clear liquid above. (This experiment is simple and elementary but very instructive). Clay soils after treatment with lime are more easily cultivated and do not crack or cake when dry.

(c). *Sandy Soils*:—Although it may appear somewhat paradoxical, *lime has also a beneficial action on light sandy soils,* rendering them more cohesive by cementing the loose particles together. This is easily understood when we consider the use of lime as a binding agent in the preparation of mortar.

GENERAL EFFECTS OF LIME.

The general effects of the application of lime can be conveniently classified as follows :—

1. Mechanical or Physical.

2. Chemical.

3. Biological.

The chemical and biological effects of the action of lime on soils are closely connected, since the biological effects are productive of changes in the chemical compound present in the soil.

These effects are general to a greater or less extent for all types of soil.

1. *Mechanical Effects of Lime on Soils.*—The first of these has been sufficiently dealt with above in discussing the application of lime to peaty, clayey and light sandy soils.

2. *Chemical Effects of Lime on Soils.*—Lime acts directly as a plant food, some plants requiring comparatively large quantities—one of its principal functions appears to be to strengthen the woody portions of trees.

The effect, however, of lime as a direct plant food is of minor importance as compared with its indirect action on soils, due to its action as a base.

It acts indirectly by rendering available the dormant fertility of all soils. It liberates potash from the insoluble silicates with which it is combined. Quicklime or slaked lime is preferable to lime-stone for this purpose.

It also assists the decomposition of organic nitrogenous matter, when not present in excessive quantity, and is thus especially beneficial in this respect on peaty soils.

It corrects soil acidity which is generally harmful to vegetation Many coarse grasses, sedges and other weeds which only flourish on acid soils disappear after the application of lime.

It also renders phosphoric acid available by liberating it from its combination with iron and alumina, with which phosphoric acid must be usually combined in the laterite soils in this country.

It is also essential after the application of repeated dressings of other manures such as ammonium sulphate, kainit and super-phosphates, the accumulated effects of which are to produce acidity. Thus in general the application of artificial manures necessitates a corresponding increase in the application of lime.

Biological Effects of Lime.—The biological effects of lime on soils, as stated before, are intimately connected with the chemical effects.

It is essential to the successful action of nitrifying bacteria, to combine with the nitric acid produced by these bacteria. It generally assists other fermentative actions in the soil, since those which are of benefit only occur in the presence of some base such as lime, whereas deleterious fermentation changes occur in sour soils in which nitrogen is actually liberated and escapes into the atmosphere.

Another important function is its inimical action on a number of fungoid root diseases, the particular instance in connection with the cultivation of Para rubber trees being its action on *Fomes semitostus.*

Compounds of Lime.—It must be remembered that the benefits to be derived from liming so-called are almost entirely dependent on its value as a base and not because of the calcium it contains as a direct plant food, so that it must be applied in one of the following forms—quicklime, slaked lime, or chalk (or other forms of the carbonate, such as limestone).

Whether applied as quicklime or slaked lime, which are both oxides of calcium or "lime," it is converted eventually into carbonate by the carbonic acid present in the atmosphere or the soil.

The application of lime in the form of chalk (a soft limestone) so common in many parts of England, is probable known to most planters in this country. There are, however, no deposits of this nature in the Malayan Peninsula. It is preferable, however, to apply lime in the form of quicklime or slaked lime rather than as chalk or limestone as, although eventually the lime is carbonated in the soil, the particles of quicklime or slaked lime are much finer than either chalk or limestone can be reduced to by grinding and are thus more readily incorporated in, and absorbed by the soil.

METHODS OF APPLICATION.

If quicklime is employed as a dressing it should first be heaped and slaked with water and allowed to fall to a dry powder—"slaked lime,"—as if quicklime is spread broadcast over the soil it tends to form lumps and is not easily converted to a powder.

If "slaked lime" is used, it can be immediately spread over the surface of the soil.

"Ground lime" which in the end is more economical cannot be obtained in this country (unless perhaps at the marble works at Ipoh, Perak, F.M.S.).

With trees under two years old, the preferable method would be to dig shallow circular trenches with a radius of about two feet round each tree, and apply to each tree individually.

On older clearings where the roots of trees interlace it would be more economical and equally effective to broadcast the lime, and fork over the whole surface of the area treated.

An application of at least 5 cwt. per acre should be used, or four times the quantity on peat soils and on heavy clay soils. A second application of 5 cwt. might be applied in the subsequent year.

GENERAL REMARKS.

It should be borne in mind that all manurial treatment of this kind should be carefully checked in order to ascertain whether the effects produced are sufficient to warrant the expense incurred.

It is useless, as some planters and even some supposed trained investigators do, to carry out field experiments of this kind or any other, without checking the effects on a sufficiently large area. At least 100 trees should be kept as a control, adjoining the area treated, and these, together with at least 100 trees that have been "limed," or manured as the case may be, should be measured before treatment and subsequently, and if tapping has commenced the dry rubber yield should be checked in each case over a long period.*

The effect of "liming" is unlikely to be felt within six months or even a year, even in a hot humid climate such as this; more especially is this the case, when lime is applied during such a drought as has recently been experienced. It is preferable, however, to apply lime and other manures in this country of copious rainfall, during a comparatively dry season.

Lime is not a very soluble manure and its action is consequently slow.

B. J. EATON, F.I.C., F.C.S.
Agricultural Chemist, F.M.S.
In "Agricultural Bulletin of S. & F. M. States," Sept., 1911.

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* The plots must be in triplicate at least to be in a position to check the Experimental Error. Readers are referred to the articles on the "The Experimental Error in Field Trials" by Prof. J. B. Harrison and Mr. F. Stockdale in the October, 1909 and January, 1910 numbers of the *Journal*.—[ED.]

The Rubber Exhibition and After.

Now that the exhibition at Islington is over it is perhaps possible to co-ordinate a few ideas out of the chaos of mixed impressions that so colossal a show tended to produce in one's mind.

Thirty three (or was it 34 ?) countries or Governments made the bravest show of their best and innumerable manufactures, not only of rubber goods but of machinery and allied articles, which filled a wilderness of space with kaleidoscopic samples, wonderful photographs, weird slices of savagery, whirring machinery and complicated cutlery.

PLANTATION RUBBER.

Out of it all, Ceylon and Malaya came out with the honours of war. Their exhibits lacked the picturesque savagery and the artistic setting of the Congo pavilion and the Brennus-like tonnage that Brazil dumped into the scale, but they were put in a neat setting and showed the commercial superiority of British plantation-grown rubber in a marked way, while any visitor in search of information was "coached" on the spot by experts such as Mr. Bamber, Mr. Petch, Messrs. Baines, Golledge, Ingleby, &c., who spent hours daily in what was at times (with the thermometer trembling on the verge of the nineties) anything but a light task. They often had, too, to "suffer fools gladly" with but rare interludes of compensating humour, as in the case of one gentleman who, at the conclusion of a half hour's demonstration of "Hevea from the V cut to the Venesta," wanted to know: "Have you ever any difficulty in coagglutinating your latex ?"

From the Congo, perhaps, we might pick up one tip for the future and that is to copy the beautiful little series of cut-out scenes representing :—

1. The Virgin Jungle.
2. The New Clearing.
3. The year old Planting and Kagan Bungalow.
4. Rubber on Tap.

These might easily be reproduced in the Colombo Museum or better still in the Arcade or one of the Colombo hotels.

RUBBER PAVEMENT.

Much interest was shown in the exhibits of Rubber Pavement but it must be stated frankly that we are a long way off seeing this in general use even were rubber to go to 2s. 6d. per lb. As far as the unbiassed critic can judge it is hopeless, when wet, as far as horse traffic is concerned and not at all easy to steer a motor over under the same conditions without considerable danger of side slip. In any place also where oil or petrol is likely to be spilt rubber pavement is clearly impossible. Under cover, however, and in such places as Railway waiting-rooms, vestibules and passages where people come in from without with muddy boots and where luggage is noisily dumped, a rubber pavement is the ideal flooring. It has been in use for some time at the North British Station Hotel, Union Street, Glasgow, and is there an established success.

It should not be beyond the resources of the Ceylon Government to lay a small experimental patch at the Colombo jetty, at Maradana station, and at Nannoya. I am quite sure that manufacturers would be only too willing to co-operate by placing their goods on view at the narrowest margin of profit—where the ultimate advertisement would be so directly to their advantage.

Failing Government initiative (and in these cases the attitude of the Ceylon Government has been compared aptly to that of the Griffin on the west front of Amiens Cathedral which stoppeth up one ear with its tail while it buries the other in the mud) the Planters' Association might take at least the pourparlers in hand.

SYNTHETIC RUBBER.

So far as practical demonstration is concerned this remains exactly as it was two—nay—ten years ago. There was on show a row of bottles of volatile, translucent, evil-smelling fluids of a benzinery, turpentinery type, a half-dozen or so of photographic developing dishes with what looked like American chewing gum in various stages of mastication, some 2½ ounces of inferior-looking rubber which speedily gave way under the perpetual pulling about, and that was all! Statements were made that the rubber could be made for 6d. to 8d. per lb. from starch, sugar or sawdust, but there was not one tittle of evidence to go before a jury beyond the mere *ipse dixit* of the puppet who was in charge of the stall. A practical demonstration was given which produced in the course of some 3 or 4 days, about a couple of pounds of the inferior rubber alluded to, but I have heard of no valuation of the resulting product, either

raw or vulcanised. No! as far as synthetic rubber is concerned the Ceylon rubber planter can go to sleep for a year or two yet without risk of his slumber being disturbed by the synthetic nightmare. It must also be remembered that it would take many years of cautious practical experimenting before the manufacturer would dare to apply this new product to any major work, such as a deep-sea cable or a large generating plant. The slightest rise in the price of turpentine, the fall of real rubber to 2s. 6d. per lb., heavy capital expenditure on machinery, danger from fire in the producing factory—factors of this kind are all dead against that alnaschar-like vision of the logroller of synthetic rubber.

VULCANISATION OF RUBBER ON THE ESTATE.

There are, however, not wanting signs that at some not distant date something may be done to vulcanise rubber before shipment from Ceylon or Malaya. The process is so excessively simple and it so effectively prevents the daily alternation in quality and appearance of unvulcanised rubber of all grades (except block or very thick sheet) which now occurs, that it only requires a steady and continuous effort on the other side of the water to ensure a steady London demand. Out and out the best sample of rubber in the show was a vulcanised piece of thin sheet from Gikiyanakande. This was vulcanised in England, but it remained unaltered throughout the three weeks it was on show while unvulcanised estate samples were altering from day to day under the influence of heat, light oxygenation and enzymes. Even in the case of block rubber strips of discolouration would appear, showing molecular changes even in the heart of the component sheets of the block.

A PRACTICAL PROOF.

When I was in Bombay a couple of years ago a steamship owner told me that he had some honey-comb rubber mats and staircase flutings made from estate rubber vulcanised in Singapore, and that the articles produced were no dearer than, and lasted three times as long as, the British-made article. However much such a statement may need to be discounted, it opens up a vista of possibility which would justify as much expenditure as we Ceylon planters spend on pushing Ceylon tea in America and elsewhere.

PACKAGES.

In the matter of packages it was a case of " Eclipse first and the rest nowhere " as there was nothing to compete with the " Venesta " packages. The perfectly smooth interior of the birchwood veneer

adapts them specially for use for packing rubber. I presume that by this time all rubber planters are aware that it is the inside of the rubber package that requires the most careful planing, as any splinters or roughtags become incorporated with the surface of the rubber, are exceedingly difficult to remove and (if present) may cause a considerable loss in price. All this is obviated by the "Venesta." In the case of tea where freights are low many planters have failed to find that the saving in freight on Venestas pays for the extra cost over the "dllomi" or the country package, but where (as in an account sale before me while I write) freight from Port Swettenham amount to 75s. per ton, and the port rate, &c., to 37s. 6d., a saving of 10 per cent. on 112s. 6d. per shipping ton is a factor not to be neglected. There are still complaints that the "Venestas" are difficult to cooper up again when once opened, but in the case of rubber this is obviously of far less importance than with tea. There is, perhaps, more validity in the complaint that the batten round the inside rim of the "Venesta" makes it difficult to turn out the contents. Rubber has a curious knack of shrinking *en voyage* and moulds itself surprisingly to fit any ledge or projection in the package.

TACKINESS.

The enzyme of tackiness appears to flourish in the air space left by the shrinkage of rubber in the package. It might be worth while (where this is known to occur frequently) to paint the inside of the package with a 10 per cent. solution of formaline. Personally I should be tempted to spray all crêpe especially with a solution of formaline not less than 2 per cent. and not more than 5 per cent. but the manufacturers are so suspicious of any innovation that such a course is at present out of the question.

CHEMISTRY.

Very little progress has recently been made in this department. The various committees appointed at the Exhibition of 1909 frankly reported that they had no completed results to lay before the Conference. One of the manufacturers who was mainly interested in the electrical applications of rubber, said that he objected to the presence of acetic acid in rubber as this made it useless for his purpose. It was pointed out that it was impossible by even prolonged washing to remove all acetates as they were incorporated with the albuminates in the latex and were insoluble. It afterwards became evident, however, that the objection was to free acid in the

interstices of crêpe, or even more so to "block" made from crêpe containing free acetic acid.

It is therefore

VERY IMPORTANT TO PLANTERS

that all free acid should be washed out of the rubber at as early a stage as possible. Free acid can be easily detected in an instant by the use of

BLUE LITMUS PAPER

a chemical of trivial cost.

PURE WATER ON ESTATES.

It is increasingly evident that very great importance should be paid to the water supply of the rubber factory. In wet weather especially every trace of sand or matter in suspension should be removed. A case in which purity of water supply directed expert attention to the sample was that of Nikakotuwa estate, which from this cause was of stand-out quality.

DUST.

This should be avoided as much as possible especially in the coagulating room, which should be kept as clean as the best managed dairy. Wire blinds should cover the windows.

EFFECTS OF LIGHT ON RUBBER.

There is an increasing balance of evidence to show that coagulation is more satisfactory in the dark or in a very dim light. External venetian jalousies would effect this manipulated from within

COOLNESS WHILE COAGULATING.

Except in the case of coagulating by steam or smoke it appears that coagulating is most successful in a cool temperature. 60 degrees Fahrenheit is, perhaps, ideal, but this is rarely possible without ice in the low-country. By the use of fans and wetted tats, however, a certain measure of coolness is always obtainable.

DRYING ROOMS AND VACUUM DRIERS.

A large number of the biggest producers of rubber, especially in Malay, appear to be prejudiced against the use of Vacuum Driers. Be this as it may there appears to be little doubt that the best rubber is produced at a temperature of 150 degrees Fahrenheit

in a free current of air at the normal atmospheric pressure. It is difficult to see how the vacuum could have any injurious effect, but perhaps it is that errors of manipulation are difficult to detect in driers used when the superintendent is not actually present.

CHEMICAL TESTS FOR RUBBER.

The brokers appear to value rubber entirely by the old rule of thumb methods with which we were made familiar at Peradiniya in 1906. The great drawback of testing raw rubber even chemically seems to be that two samples of rubber (giving identical results when tested chemically and by the usual tests for breaking strain, resilience, etc.), behave quite differently when vulcanised.

Resin, for example, is looked on askance by many buyers, but actual tests have proved that rubber containing 8 per cent. of resin has in certain cases given tip-top results from the manufacturers' point of view. The finest hard Para often contains quite high percentages of resin compared with ordinary plantation.

OVER-ROLLING.

There appears occasionally (not as a rule, however) to be a certain amount of injury done to rubber by overworking on the rollers. This is, perhaps, most remarked in scrap from bark (even live bark, not dead and cankered stuff). On the other hand, there is the paradox that dead recovered rubber which has completely lost its elasticity is often magically revived by rolling.

SUMMARY.

I hope that these remarks may prove of some value to those practical planters in Ceylon who were unable to attend the Rubber Exhibition. I think I have said enough to show that an enormous field remains open for investigation. To sum up, I should think—(1) an ample supply of clean water, (2) a cool, dark coagulating room, and (3) a quick cure, are the three great desiderata of rubber manufacture.

—J. R.

—"Times of Ceylon." (From *Tropical Agriculturist*, Ceylon, October, 1911.)

A Phenomenal Sample of Plantation Rubber.

THE rubber came from the Glenealy Plantations, Ltd., Perak, Federated Malay States, and was exhibited on the British Malayan Stand and numbered 71. It was medium coloured, unsmoked sheet, approximately one-eighth inch in thickness and measuring about 24 ins. by 12 ins. It was even in texture, translucent, of a warm brown colour and outwardly of good quality, though some of the sheets were slightly spotted with mould. It was kindly tested by the Continental Rubber Company, of New York, in the Exhibition; the figures being:—

	Breaking Strain.		*Elasticity and Recovery.*		
Name of Sample.	*Break.*	*Extension.*	*Pull.*	*Pull after 5 Minutes.*	*Permanent set after 5 Minutes' rest.*
Glenealy	64lb.	$8\frac{3}{4}$ins.	25lb.	$21\frac{1}{2}$lb.	10
Fine Para	58lb.	$9\frac{1}{2}$	$19\frac{1}{2}$lb.	17lb.	8

It will be seen that the breaking strain is 6lb. more than for fine Para; this equals 10.35 per cent. greater strength. The resistance to pull is more by $5\frac{1}{2}$lb. and by $4\frac{1}{2}$lb. after five minutes extension; equal, respectively, to 28.20 per cent. and 26.47 per cent. greater resistance to pull. As in the former case, fine Para has the slight advantage of 1.50 per cent. in permanent set after five minutes extension and five minutes rest.

Mr. E. F. C. Garland has kindly supplied me with the following details respecting the growing and preparation of this rubber. The Glenealy Estate is situated near the Perak River at Parit six miles from Seputek. Parit is about twenty miles, as the crow flies, from the sea coast, and eighty-five, following the course of the Perak river. The trees are twelve years old and under, planted experimentally by the Government in avenues on sloping ground of gentle undulation; the avenues had Merban (*Afzelia palembanica*) trees planted between them, which Mr. Garland had cut out in 1906-9 at the same time as the lalang was eradicated, and young rubber planted in place of them. The field is forty acres in extent and only about 2,500 trees are now being tapped giving an estimated yield this year of 10lb. per tree.

Acetic acid is used for coagulating, diluted with water to make a 10 per cent. solution, the general basis of mixture being one fluid drachm of dilute solution to one quart of latex; equal to 0.31 per cent. of acid. It is added gradually to a large jar of latex, whilst

the contents are being stirred with a stick. The latex coagulates in porcelain pans within two hours, and is finished off by a hand mangle the same day. Absolute cleanliness is essential, and the only metal the latex touches is the galvanised spouts on the trees, the rollers of the mangle being of wood. The sheets are dried in the factory for forty-eight hours before being moved to the drying shed, which is about fifty yards distant. To the above description, which is given nearly his own words, Mr. Garland adds : " There are certain special points about quality of material used for the factory, which are my own ideas, not generally shared by planters. "

It is difficult to say wherein lies the secret of the high quality of this rubber, for in essentials the process of preparation, as far as can be made out from the description given, does not seem to differ materially from that generally adopted on other estates.

L. Wray in " Agric. Bulletin " of the Straits and F. M. States, Oct., 1911.

Ceylon Copra Methods.

So far as we are aware, planters and copra-driers have not departed from the old methods. In dry districts exposure to the sun during the day, and heaping up at night, is the usual routine—we should say was, because fire-drying is resorted to, even there more frequently now. For smoke-drying, cocoanut shells, which scarcely smoke, while giving out a maximum of heat, are the material used. The loft, with areca nut laths ½ in. apart, 5ft. to 6ft. above the floor of the drying shed, is heaped two or three deep with the split nuts, while the shells are fired under, fitting into each other, in rows 4ft. or 5ft. apart. The result is perfectly white and clean copra in three days, of two fires each day. . . . .

No doubt the same process obtains generally, *viz.* :—The ripe nuts are plucked and allowed to wither, or mature, the best part of a month ; then they are simply cut in two and either sun or fuel dried —it being a well-known fact that with regard to Ceylon the best is made at Kalpeutyn, some twenty miles north of Puttalam, where they have very little rain and where they place the newly-opened nut in the sun on the hot sea sand, this process being unequalled elsewhere ; although I must say our best estate copra runs it very hard ; in fact it often fetches the best price in our market.

All over Ceylon the common copra kiln is used when there happens to be no sun, the fuel used being the cocoanut shells which leave the kernel after a couple of days good drying in the sun, or over the fire in the kiln.

" The Queensland Agricultural Journal," September, 1911.

Hints, Scientific and Practical.

Theories of Plant Nutrition.

In an article entitled "The Soil and the Plant," which appears in the current issue of *Science Progress*, Dr. E. J. Russell, of Rothamsted, discusses some recent American hypotheses on plant nutrition. According to the generally accepted view, manures benefit plants by directly supplying nutritive materials. For example, when, phosphates are added to the soil, it is believed that they go to supply the phosphorus required by the growing plant. Of recent years, however, a different view has obtained some vogue. It orginated in America, and has been adopted by the Bureau of Soils of the United States Department of Agriculture.

The new hypothesis is based on the assertion that the "concentration" of the soil moisture is always constant, whatever the manurial treatment may have been; in other words, it is asserted that the amount of nutritive salts in solution in the soil water remains constant.

If this is true it follows that the chemical constitution of the soil is without effect on plant growth; fertility must depend upon the physical factors regulating the supply of soil solution to the plant; for if the soil solution is always the same, plants can obtain more nutritive substances only by obtaining a greater volume of the solution. To complete the hypothesis, it is asserted that infertility is often due to presence in the soil of toxic substances, some of which have undoubtedly been isolated. The old hypothesis of de Candolle is thus revived, and the toxicity is believed to be due to the presence of substances excreted by plants in the normal processes of growth, such substances being harmful to other plants of the same genus, but not necessarily harmful to plants of a different kind.

A convenient explanation is thus provided for the beneficial action of rotation of crops and the sterility which results when the same crop is grown continuously on the same ground. In order to explain the unquestioned beneficial effects of fertilisers, which the above hypothesis would seem to negative, it is supposed that they act either on the distribution of the soil moisture, or as antidotes to the toxic substances.

In discussing this hypothesis Dr. Russell in the first instance points out that the evidence is insufficient to establish the primary assumption that the soil solution is constant for all soils. Figures are quoted

to show that the concentration, while showing little absolute variation, yet relatively differs considerably. The difference between 5 parts per million and 30 parts per million, when stated in concrete figures, is small, but relatively it is equivalent to a difference of 500 per cent. Moreover, the irregular distribution of the figures, showing the number of results for each degree of concentration, suggests that the variation is outside the ordinary experimental error.

In the next place, Dr. Russell contests the view that variations in the soil concentration do not influence the rate of plant growth, and consequently are without influence on fertility.

He points out that, while there is always a limiting factor which controls the situation, the amount of growth in nutrient solutions tends to increase as the concentration of salts is increased.

With regard to toxic substances, it is pointed out that it is not surprising that some of the numerous organic compounds in the soil should have a toxic action when supplied to the plant through the medium of a water culture. It does not follow that such substances retain their toxic properties when added to the soil. In regard to the phenomena associated with "sour" soils, the writer is, however, prepared to admit that toxic substances may be present.

In regard to the excretion of toxic substances during the normal processes of growth, Dr. Russell is able to bring forward the results of his own work at Rothamsted, and to show that there is no evidence in support of this hypothesis. Plants grown continuously in water, sand and soil cultures for as many as six generations, have shown no signs of suffering from toxicity. Again, wheat has been grown continuously in the Broadbalk field at Rothamsted for sixty years, but so far there is no signs that the plot is suffering from the presence of any toxic substance.

It must be admitted that the investigations of the Bureau of soils have served a useful purpose in directing attention to factors of fertility other than the chemical composition of the soil. Physical conditions undoubtedly play a more important part than the earlier chemists were disposed to assign to them, but investigation on fertility cannot be restricted to chemical and physical conditions: the biological changes which go on in the soil must be investigated and these again cannot be restricted, as they have been hitherto, to the bacterial flora. As Dr. Russell's work on soil sterilsation demonstrates, higher forms of life are probably at work, and may exercise a profound influence on plant growth.

—The Journal of the Board of Agriculture (England).
Nov., 1911.

The Absorption of Food Substances and Poisons through Leaves.

It has hitherto been generally accepted in Plant Physiology that the leaves of flowering plants are organs specially adapted for carrying out gaseous exchanges with the atmosphere, and that they have comparatively little power of absorbing either water or solids which may be dissolved in water wetting the surface of the leaf. In the case of such plants as mosses, lichens and in the leaves of carnivorous plants, however, a very pronounced power of absorbing water and dissolved solids is shown. The same, of course, also applies to the leaves of water plants which grow completely submerged in water. In fact, whether a leaf will be able to absorb water and dissolved solids or not, depends mainly upon the thickness and character of the outermost layer or skin, known to botanists as the cuticle. This varies greatly in its thickness and impermeability to water, according to the kind of leaf or the conditions under which it has grown ; but, even in the case of a leaf like that of the beech which has a fairly well developed cuticle a simple experiment suffices to show that solids can be absorbed directly through the outer surface of leaf. For instance, if a drop of a very dilute solution of potassium nitrate be placed upon a beech leaf and covered with a small bell-jar so as to check evaporation when the drop finally disappears no crystals are left behind on the surface of the leaf; whereas, if the drop is allowed to evaporate rapidly a little crystalline efflorescence is left behind, owing to the fact that the salt had not time to be absorbed before the water had evaporated. Of course, in a condition of Nature, rain water usually does not contain more than traces of dissolved salts and usually does not remain long in contact with the leaf. Nevertheless, some recent investigations published in the "Mitteilungen der Deutschen Landwirtschafts Gesellschaft," 1911, page 231, by Professor Hiltner, Professor of Agriculture at the University of Munich, seem to show that quite appreciable quantities of both food substances and poisons may be absorbed by the leaves when such substances are sprayed on the foliage, either dissolved in water or in suspended form.

Some instances of this power of absorption through the leaves have long been known. For instance, if the leaves of a plant happen to have become pale coloured, as sometimes occurs owing to a deficiency of iron in the soil or to a difficulty in absorbing it, then merel painting the pale surface of the leaf with a dilute solution of chloride of iron will restore the green colour temporarily or permanently to the leaves so treated. Another instance, in this case of the absorption of a poison, is the well known use of copper sulphate to keep down Charlock or Wild Mustard in cereal crops. The copper

solution adheres long enough to the Charlock leaves to be absorbed by them and to cause their death, whereas the solution runs off the grass leaves without affecting them to any appreciable extent. Professor Hiltner's experiments seem mainly to have been directed towards determining whether it would be possible by spraying potassium salts on the leaves to obtain a more rapid response than if the salts were applied to the soil. Criticial experiments were performed with mustard and soy leaves, from which it appeared that neither nitrogenous food (nitrates, ammonium salts, asparagin) nor phosphoric food (surperphosphate, basic slag), could be absorbed through the leaves in sufficient quantity to make good a deficiency in the soil, however carefully and thoroughly these substances were applied to the leaves. In fact, if superphosphate, for instance, was applied to the leaves in the form of powder, it was found to destroy them almost entirely. On the other hand, it appeared that potassium salts could be absorbed readily through the leaves of mustard plants in the form of potassium sulphate, and preferably as potassium chloride in the case of the soy beans. This was evidenced by the the weights obtained in the following pot experiments :—Without potassium the yield was 15 grammes ; with chloride of potassium applied to the soil, 38 grammes ; with chloride of potassium sprayed on the foliage, 43.5 grammes ; with potassium sulphate applied to the soil 45.5 grammes ; and with it sprayed on the foliage, 43.5 grammes.

Proper care seems to have been taken to ensure that the salts brushed or sprayed on the leaves did not reach the soil. It is, however, too early to say whether these results may prove to be of practical importance in agriculture, but they are to be continued, and may ultimately prove to be of great value. It might, in fact, be found in some cases that spraying the foliage of a crop with a dilute solution of a potassium salt might just give it the required fillip at a critical stage of its existence and enable it to make good a previous deficiency or to overcome a threatened attack of disease. If such results can be obtained with food substances in the form of sprays, they would, of course, be preferable to poisonous sprays, provided they were equally effective.

A. J. Ewarts D.Sc., Ph. D., F.L.S. (Govt. Botanist) in "The Journal of the Department of Agriculture, Victoria." Sept. 1911.

Answers to Correspondents.

Specimens received from H.M.G. (Potaro).

Orthoptera. *Blattidae* 1. *Mantidae* 2. *Gryllidae* 2. *Locustidae* 3.

Hymenoptera. *Bembecidae* 2.

Coleoptera. *Longicorns* 2. *Curculionidae* 4. *Scarabidae* 1. *Chrysomelidae* 1.

Neuroptera. *Myrmeleonidae* 1.

Lepidoptera. *Nymphalidae* 8. *Syntomidae* 1. *Sphingidae* 1. and 5 Lepidopterous larvae.

A.A. (North West).—The specimens of insects you sent down as attacking Heveas are *Locustidae*—2 adults and 3 nymphs. Their exact species I am unable to determine. They should be kept well under observation and if they appear in large numbers they may be kept in check by the use of an arsenical wash or poisoned baits.

Specimens of Scale Insects from W.H.M. (Pomeroon).—*Aspidiotus destructor* on Liberian Coffee (leaves), *Lecanium* sp. on twigs of Robusta coffee; the same species of scale attacking limes; *Hevea brasiliensis* affected with *Lecanium nigrum* (leaves and twigs); two species of *Aspidiotus* attacking coconut palms (leaves). All these various scales are commonly met with and may be kept in check by the use of rosin compound, the formula for which has appeared before in these pages.

F. G. (Botanic Gardens).—The specimens of beetles you sent from Wakenaam are well known as causing damage to coconut trees in various stages. The male insect may be distinguished from the female by the presence of a horn, which is but slightly developed in the female. The larva is undoubtedly that of this beetle—*Strategus alveus*.

E. W. (Greenwich Park).—The insects attacking your coconut trees were *Rhyncophorus palmarum*. Both male and female insects were sent. The two sexes may be distinguished by the male having a bunch of short bristles on the top of the proboscis. The infested tree which you cut down should be destroyed by being burnt or it will serve as a source of infection to the other trees in the neighbourhood.

W. G.—The coffee leaves show signs of having been infected by leaf-miner. No trace can be found of the fungus spots that you allude to, but perhaps younger leaves should be sent for examination.

G. H. W.—The Hevea trees have undoubtedly been affected by a wood-destroying fungus. Entrance has most probably been effected at the "collar" of the plant, as considerable shrinkage and destruction of the tissues have taken place. The fungus seems to have mainly travelled downwards and to have destroyed root tissues. No fructifications are to be found and therefore identification is not possible. The places from where the trees have been removed should be forked deeply and dressed with a good application of quick lime.

RUBBER.—Care should be taken in planting out Hevea rubber plants in the field. They should not be planted too deeply or otherwise fungus diseases may affect their softened stem tissues placed below the level of the ground. A common mistake made in this colony is the packing of mulch up around the stems of permanent trees. This should in no case be allowed, particularly with Para rubber.

COCONUT.—Bud-rot is supposed, at the present time, to be conveyed from tree to tree by the agency of insects. This has not yet been definitely settled, but it is essential that coconut trees affected with bud-rot should be cut down and properly destroyed by burning or by burial with lime. That bud-rot can be checked by the removal of all the trees that have been affected and by attention to the remainder of the cultivation has been demonstrated by the Board of Agriculture of Trinidad. Remedies are being sought for in many countries for this trouble.

W. E. A.—The rot of this coconut may have been due to its having been planted in a low, unsuitable, water-logged situation. No insects could be detected and the fungal mycelium (*Diplodia* sp. ?) could only be found in the decaying tissues and therefore could not be responsible for the damage done.

S. P. & Co.—The canes have been attacked by the ordinary rind-fungus and show *Melanconium* spores in abundance.

The Model Gardens.

RECORD OF ATTENDANCES.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to March 31; April 1 to June 30; July 1 to September 30; and October 1 to December 31. The totals only of the three quarters during 1907 are given: the records since then are in detail.

QUARTERS.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd to 4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
First	597	731	389	299	187	...	...	...	...	2,203
Second	1,438	860	183	274	243	...	...	...	...	2,998
Third	¶1,698	976	440	199	212	...	...	...	...	3,552
Fourth	1,714	819	465	115*	411†	160‡	...	...	...	3,684
1909.										
First	1,638	710	338	463	370	302	...	...	...	3,821
Second	1,707	677	329	142	288	446	...	...	...	3,589
Third	¶1,252	742	433	436	172	378	223‖	...	...	4,636
Fourth	1,876	536	438	236	362	771	439	...	...	4,858
1910.										
First	1,282	769	287	370	259	489	465	...	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.

¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported during 1910. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1908	1909	1910	1911.
Sugar, tons ...	110,657	115,633	106,439	98,452
Rum, gallons ...	2,190,580	2,154,317	2,005,873	2,595,293
Molasses, casks ...	1,431	2,539	2,084	1,106
Cattle-food, tons ..	7,932	9,504	9,379	5,556
Cacao, cwts. ...	939	574	472	800
Citrate of Lime, cwts.	13	54	87	56
Coconuts, thousands	200	636	994	1,038
Copra, cwts. ...	186	467	306	1,415
Coffee, cwts. ...	190	1,122	1,049	927
Cotton, lbs. ...	12	.	...	...
Fruit, brls. and crates	60	1	..	...
Ground Provisions, value	$2,115 06	$225 32	$546 12	...
Kola-nuts, cwts. ...	1	38	9	4
Rice, tons ...	3,867	4,729	4,927	2,538
Rice-meal, tons ...	2,498	1,911	1,620	1,364
Starch, cwts. ...	...	..	4	...
Cattle, head ...	1,451	992	1,210	953
Hides, No. ...	2,979	3,490	5,569	4,617
Pigs, head ...	984	872	1,090	1,148
Poultry, value... ...	$ 234 72	$224 52	$ 72 36	..
Sheep, head ...	41	74	123	40
Balata, cwts. ...	10,040	9,231	11,302	10,289
Charcoal, bags ...	76,617	78,410	76,681	72,937
Firewood, Wallaba, etc., tons ...	7,051	8,499	10,192	9,866
Gums, lbs. ...	1,133	6,916	2,529	4,652
Lumber, feet ...	53,267	210,137	277,313	327,328
Railway Sleepers, No.	4,000	3,350	9,950	5,432
Rubber, cwts. ...	61	57	14	32
Shingles, thousands	2,996	2,122	2,463	2,599
Timber, cubic feet	214,743	219,516	278,382	234,003

Selected Contents of Periodicals.

The Production of Bright Tobacco by the Flue-curing Process.
San Jose Scale in the Transvaal.
Some Poultry Diseases.

—(September.)

The Colics of the Horse: Causes, Symptoms, and Treatment.
Sterilizing Tobacco Seed-beds.

—(October.)

—The Agricultural Journal of the Union of South Africa, 1911.

Tobacco Culture. (Sept. and Oct.)
To Start Farming. (Oct.)
Passion Fruit Culture.

—The Journal of the Department of Agriculture of Victoria. (Australia), 1911.

The Promotion of Agricultural Research. (Oct.)
The Cultivation of Onions
Selection of Fowls for Egg Production. (Nov.)

—The Journal of the Board of Agriculture (England), 1911.

On the Occurrence and Nature of Spots on Para Sheet and Crêpe.
Difference between Amazons and Plantation Rubber.
The Quality of Plantation Rubber.
The Date Palm.
Copra Drying.
The Eucalyptus as a Preventive against Malaria.

—The Queensland Agricultural Journal, Sept., 1911.

The Function and Efficiency of the Agricultural College.

—"Science," December 8, 1911.

Indian Advocacy of Co-operative Credit.
Co-operative Credit.
Midnapore Co-operative Conference.

—The Tropical Agriculturist (Ceylon), Oct., 1911.

The Rubber Exhibition and After.

—T. A. Supplement, (Oct., 1911).

Flies as Disease Carriers.

—The Veterinary News, August 26, 1911.

Snake-bite and its Treatment.

—Queensland Agricultural Journal, March, 1911

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Directions to Correspondents.

Notice.—Letters should preferably be written on one side of the paper only, and as far as possible, each letter should deal with one subject only, to allow of its being referred to the officer who is concerned with the subject.

Officers should be addressed by their titles, not by their names, to prevent confusion with private letters and to ensure that official letters are opened in their absence.

Letters should be addressed—according to the nature of their contents and the business dealt with —to either

The Director,
Department of Science and Agriculture,
Broad Street,
Georgetown.

or

The Government Botanist,
The Botanic Gardens,
Georgetown.

If intended for

The Editor,
The Journal of the Board of Agriculture,
or The Economic Biologist.

or The Secretary of the Board of Agriculture,
letters should be sent to
Broad Street,
Georgetown.

Parcels should always contain the name of the sender If this is not done, it is often impossible to tell from whom they come, in the case of several arriving at the same time.

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"Agricultural Education."

It can hardly be said that "Agricultural Education" is a subject which grows clearer by discussion. The circumstances of the various colonies which go to make up the patch-work called the West Indies are so diverse; the conditions of the people concerned differ so much from place to place; the objects aimed at by those whose business it is to organize are necessarily so governed by local conditions; the methods recommended vary so widely; and each speaker in any exchange of views assumes so lightly that all his hearers are acquainted with the fundamentals of his position without his taking the trouble to define them; that the subject begins to rival religious discussion for confusion of thought and absence of conclusion. With the recent debate which took place at the Agricultural Conference held in Trinidad last January fresh in our mind we must ask for some clearing of the ground and marshalling of facts if profit is to accrue.

Let us begin, then, by admitting that some development of Agricultural Education is desirable in the Tropical British Possessions of the Western Hemisphere; but let us draw a clear dividing line between those who will take up agriculture as their business in life and those who will pursue some other vocation; and let us consider these latter first. We do not think we are wide of the mark when we again divide this class into two; those whose circumstances are sufficiently good to permit them to attend the secondary schools and to proceed thereafter to a profession, Government Service or the higher walks of commercial life, and on the other hand those who must attend the primary schools of their colony and earn their living at an early period by manual labour, in the

humbler branches of the Service, or in the less conspicuous departments of the shop and counting house. None of either class being connected directly with agriculture, what meaning shall we attach to the term "agricultural education" in connection with these ?

Nowhere in the West Indies has town life developed to the extent or become specialised to the degree it has in the more civilised parts of Europe ; and whatever branch of non-agricultural wage-earning our youngster takes up he will find himself constantly in touch with agriculture. Its difficulties and problems will force themselves upon him in his daily reading of the newspaper, its development will be the topic of conversation in any society he may enter, its welfare must always be of primary importance to him from a monetary point of view. His business may take him into the country at any moment, departmental orders may locate him in the heart of the bush or in some purely agricultural district ; must we not see to it that his education shall be of such a nature that in any circumstances he is in harmony with his environment and is capable of performing good work therein as becomes a useful citizen ? And how can we accomplish this unless we give him, primary scholar or secondary school student, an education which has a distinctly agricultural bias ?

Let us not be misunderstood. We do not advocate the abolition or weakening of the older fundamentals of a sound education—the three R's, history, English composition, geography for all ; Latin, higher mathematics and modern languages for the secondary boys ; subjects which train the memory, discipline the mind, refine the thoughts and develop the reasoning powers ; but to these we would add a subject which would touch a side of the child's intellect neglected in the old days, some subject which can be learned not from books but from experience, not by rote but by practice, not by reading but through the avenue of the senses—a scientific subject in short. Europe at first found such a subject in Physics and Chemistry with all their elaboration of material and expensive equipment of laboratories ; and lack of originality (we fear) led to imitation in the West Indies. Europe has now added the Study of Nature and Manual Training. Most English public schools of the present day possess carpenter's shops, engineering appliances, lathes, forges even, which the boys have to learn to use not with the idea of making carpenters of them or engineers or blacksmiths but to develop that side of the brain which learns by practical experience—to complete the education. Why not strike out a line for ourselves and *begin with* Nature Study and the

School Garden ? The education these afford can be as truly scientific as Physics, the equipment will be far cheaper and more accessible than the Chemical Laboratory, the training much more in harmony with the environment present and prospective of the scholar. We assume modern method in the teaching ; and given a modicum of intelligence in the pupil we feel inclined to guarantee the result. We could produce Government officers with a useful hobby, such as entomology, outside their routine duties, Town Councillors of a legal turn of mind yet capable of appreciating the methods and results of modern tropical sanitary science, and citizens, however humble in station, willing to carry out intelligently and without compulsion the rules which are the result of that research ; schoolmasters fit to teach Nature Study because they are imbued with the spirit of the subject ; workmen able to find innocent recreation in a cottage garden ; clerks with some relief from the monotony of their duties—all with a live and soul-saving interest in their surroundings.

Naturally these people will have been brought up in the town schools ; but what of the country ? What modifications shall we expect in the country schools which serve the villages and districts mainly agricultural ? We must remember that the function of a school is to educate ; that is, to develop a child's character and intellect as a whole and not to train the youngster in any one special direction. Where our colonial children live in an agricultural atmosphere the chief need will be to take care that the intellectual side of their education is properly attended to. But we must see to it that the schoolmaster himself is of a practical turn of mind, in sympathy with country life and country pursuits; one who will correlate arithmetic, composition, geography even with the every day work of the farm ; one who will use the school garden to illustrate and give a meaning to the dull and mechanical routine of field labour ; one who will work under a system flexible enough to accommodate itself to the exigencies of farm life and modern enough to include some form of manual training in its Code. Our country teacher must be one who appreciates the dignity of labour and will uphold it by word and deed in school and out of it, and our country school will be one in which the agricultural bias is so pronounced that the education it affords may almost be called purely "Agricultural."

And so we come to consider the second of those classes into which we have divided the youth of the West Indies—those who intend to make agriculture their profession and to get their living on the

land. Here again we must divide our youngsters into two classes—those who must go to work as field labourers on estates or on small homestead grants and those whose parents can afford to give them a supplementary education which will fit them to become estate overseers, plantation managers or agricultural instructors. The first of these classes will be drawn chiefly from our country schools; and we claim that if their education has been carried out on the lines we have suggested they will be intelligent labourers for themselves or for others, and that some of them at least, proceeding by means of scholarship or otherwise to higher work, may supply the country schoolmasters of that type we so sorely need. Some, too, will avail themselves of any chance afforded them by Government courses or special classes and become foremen or gardeners or overseers—this will depend upon the special circumstances of the country in which they live, circumstances which vary enormously from one colony to another.

For the second class we must establish agricultural schools or an agricultural college; some institution in which the boy, having had a good all round education at the secondary school, will be trained in the special business which is to be his life's work. We would not take him too young; he must have a good grounding in purely intellectual studies, in habits of observation and deduction—here Nature Study and the School Garden will have helped him—and have had some manual training before he can specialise with advantage; and we must take into consideration local circumstances. But in the agricultural school his training will be primarily practical—field work correlated with the botany of crops and weeds, the chemistry of soils and manures, the biology of insects and plant pests. In some happy cases, no doubt, means may be found to develop an agricultural college with research students from whom could be drawn departmental officers and instructors in the higher branches of agricultural science, We are not without hope that our foundation would help to fill the present gap and draw from Europe students eager to learn Tropical Agriculture. But these are matters of detail: and discussion of details, we plead, is profitable only when the broad lines of a scheme have been distinctly laid down.

Notes.

Third International Rubber Exhibition, New York. THE Third International Rubber Exhibition is to be held in New York from September 23rd to October 3rd next. It is under the management of Mr. A. Stainer Manders while Mr. H. C. Pearson, the Editor of the "India Rubber World" of New York, is the Vice-President. It had been hoped that it would be possible for this colony to send a representative exhibit of rubber, balata and other products to this exhibition, and the Permanent Exhibitions Committee had obtained several promises of exhibits. At a recent meeting, however, it was decided that owing to the severe drought it would not be possible to get together a collection of exhibits that would be creditable to the colony. Particulars in regard to open competitions have been asked for in case samples of rubber from the colony can be entered in these competitions.

Rubber-trees and Shot-hole Borers. As the question of Shot-hole Borers (*Bostrichidæ* or *Scolytidæ*) attacking the diseased tissue of rubber trees has on several occasions been brought to our notice we reprint the following note by Mr. E. E. Green, Government Entomologist in Ceylon, from "Plant Sanitation" in the January number of *The Tropical Agriculturist*, which entirely agrees with the opinion we have given in every instance.

"A similar misconception is now arising in the case of Hevea rubber. The rubber trees are subject to several serious fungal diseases, including a canker very similar to that of the cacao. Sections of trees, said to have been killed or injured by boring beetles, are repeatedly sent in to this Department, but a careful examination of the specimens has invariably revealed the presence of one or other of the fungal diseases. In no instance have borers been found in sound healthy bark. A healthy rubber tree is protected from boring insects by the viscid latex which exudes from any wound and overwhelms any insect intruder. In the incipient stages of canker only the superficial layers of bark are involved. Borers will attack these spots and will attempt to gain an entrance: but as soon as they reach the deeper and as yet unaffected layers of bark, they are repelled by the flow of latex. In older stages of the disease, when the whole thickness of the bark is involved, latex is absent from the diseased tissues, and there is no hindrance to the progress of the insect, which can then per-

forate the bark with impunity and even extend its galleries into the wood itself. It sometimes happens that latex is found to be exuding from the perforations and flowing down the stem. This is often taken by the planter as proof positive that the beetle has attacked the healthy laticiferous bark. But the phenomenon is explicable in other ways. In the early stage of the disease, when only the superficial layers of the bark are affected, latex may exude from the deeper tissues through the abandoned galleries of insects that have attempted to push their work beyond the limit of the diseased layer. Another cause of bleeding may result from the separation of dead bark from the wood, leaving a cavity which often becomes filled with latex from surrounding healthy tissues. If the dead bark is imperforate the latex coagulates and forms a pad: but if the bark is pierced by shot-hole borers, the latex finds its way to the surface. It is possible, even, that borers might attack otherwise healthy bark during a temporary cessation of activity in the laticiferous vessels resulting from excessive drought or overtapping. Should this happen, a shower of rain might result in renewed activity and bleeding through the perforations would occur. The exudation of latex and presence of boring beetles may usually be looked upon as a valuable indication of incipient disease, thus allowing of early treatment before the disease has become deep seated."

G. E. B.

Weevils in Rice.

When rice has been stored for some length of time small dark brown weevils often make their appearance, and if left for any period will cause very considerable damage. The eggs are laid on the grains themselves in little indentations made with the parent insect's jaws, and the larvæ when hatched eat into the grain, in many cases completely hollowing it out. This weevil (*Calandra oryzae*) is abundant in all the warmer parts of the world and attacks nearly every variety of grain. The following hints for storing rice against the attacks of this pest, though by no means new, should prove of value. All rice, either as paddy or otherwise, which is to be kept for a period of time should previously be fumigated as this prevents any possibility of weevils in any of their stages of existence being stored with the grain, multiplying therein, and doing damage. The bin or box in which the rice is to be put should be absolutely insect-proof. A metal-lined box with a tight-fitting lid is the best. The box should be well cleaned before the rice is placed in it, as any dirt or old

grain may harbour weevils or eggs and thus infect the grain. As soon as the rice has been fumigated it should at once be transferred to the insect-proof storing box to prevent infestation while lying about. Fumigation consists in the exposure of the grain to the fumes of carbon bisulphide for a certain period of time, and may be carried out in any box provided that it is air-tight. The food value or germinating capacity will not in the slightest be impaired thereby. The bisulphide is placed in shallow trays on the top of the seed and left for 24 hours. One ounce of carbon bisulphide should be used for every 15 cubic feet of the area to be fumigated. At the end of this time no insects will be left alive and even their eggs will be destroyed. The bisulphide may be poured on the grain itself without doing any damage. It should always be borne in mind that carbon bisulphide is highly inflammable; great care should therefore be exercised in its use.

G. E. B.

The Benefits of Tillage.

What are these benefits? Professor L. H. Bailey enumerates them as follows :—

1.—*Tillage improves the physical condition of the land.*

(*a*) By freeing the soil, and thereby presenting greater feeding surface to the roots.

(*b*) By increasing the depth of the soil, and thereby giving a greater foraging and root-hold area to the plant.

(*c*) By warming and drying the soil in spring.

(*d*) By reducing the extremes of temperature and moisture.

2.—*Tillage may save moisture*—

(*e*) By increasing the water-holding capacity of the soil.

(*f*) By checking evaporation.

3.—*Tillage may augment chemical activities.*—

(*g*) By aiding in setting free plant food.

(*h*) By promoting nitrification.

(*i*) By hastening the decomposition of organic matter.

(*j*) By extending these agencies (*g, h, i.*) to greater depths of soil.

All these statements, except that in relation to the warming of the soil in spring, are as applicable to conditions existing in the tropics as to those of the temperate zones.

—Quoted by the "Queensland Agric. Journal": Jan., 1912.

The Cultivation of Coconuts in British Guiana.

THE steady increase in the areas planted with coconuts throughout the colony is encouraging and indicates that interest is being taken in the cultivation of this valuable palm. The latest returns show that over 12,000 acres are now planted with coconuts, whereas seven years ago there was but half of this. Even so, this area is but a small fraction of the land that is suitable for coconut cultivation in the colony. The recent increase in the value of coconut products has resulted in closer attention being given to the cultivation of this palm, and many of the smaller proprietors are planting up considerable areas. Sugar proprietors have also of late decided to put under coconuts an increasing area of their coastal lands abandoned from sugar-cane. It is also hoped that the so-called "coconut boom" of the moment will tend to stimulate local proprietors to further efforts in planting coconuts, and that it may lead to the introduction of foreign capital for this culture.

THE FRUITS OF NEGLECT.

In passing through coconut plantations in the colony one is distressed at the neglect that is only too often seen at practically every stage of the plants' growth. A large number, if not the majority, of planters seem to be under the impression that once the nuts are planted or seedlings put in, no further thought or attention need be given to the fields until the plants are due to come into bearing. Too often are coconuts cut out of "bush" at 5 or 6 years of age and it is found that they have only made the same progress that they would have done in two or three years if proper attention had been given them. Why should coconuts be expected to thrive if they are neglected, and when will it be realised that coconuts respond to good cultivation and careful treatment as readily, if not more so, than many other tropical products? The present article indicates in what direction improvements can be made and how far beneficial results may be expected from thorough and practical cultivation. The coconut deserves much better attention from the planter than it generally receives.

THE BEST LAND FOR COCONUTS.

The coconut for its best development requires a good sandy loam, but certain strains will also grow well on heavier land if this is well drained. The coconuts growing in the colony are scattered, but the principal localities are the Mahaicony-Abary dis-

trict of the East Coast of Demerara, the Essequibo and Courantyne coastal lands, where sandy loams occur, and the Essequibo Islands, where the lands are heavier. Large areas have also been planted up in the villages, and the plants are progressing favourably. Some of the lighter lands of the colony are excellent for coconuts, and good-sized nuts are grown on heavier lands where good drainage is given and thorough cultivation practised. On the pegassy or pegassy-clay lands coconuts do not do well. They will grow fairly satisfactorily if good drainage is provided, but they give only small yields of inferior nuts. Coconuts do not in this colony grow so well nor yield so satisfactorily on river lands, away from the coastal region. There the nuts are generally small and the yields poor.

THE SELECTION OF SEED NUTS.

The first attention of the coconut planter should always be the selection of his seed nuts for planting purposes. Yet this matter is often neglected and not infrequently totally disregarded. Any nut that has a sprout on it is called a "plant" irrespective of its source or condition. The importance of seed selection is recognised more now than it was a few years ago, and planters look for big nuts for planting purposes. How often are these big nuts delusions? They often consist mainly of husk, and are produced by trees that give only small yields. The essential in seed selection is to know the tree from which the nuts come. Coconuts vary very greatly in their yielding capacity: while many trees bear regular crops of good-sized nuts, others bear irregularly. Again, there is a great difference in the size and shape of the nuts. There are several kinds of coconuts in the colony, and in selection the following points should be kept in view:—

(*a.*) *The yield of the tree.* This should be ascertained from the average returns of three or four years. Special trees for seed purposes should be marked, their averages of "select" nuts ascertained and, if satisfactory, these trees should be kept entirely for seed purposes. Trees bearing large-husked nuts are often small yielders.

(*b.*) *The size of the husked nuts.* The market for nuts demands that they shall be of a certain minimum diameter. The New York market requires that all nuts shall measure at least $3\frac{7}{8}$ inches in diameter, and all nuts smaller than this are classed as "culls." The difference in price between "select" nuts and "culls" is most marked, and no one should plant a nut that does not approximate to 4 inches in diameter. Long nuts are usually of small diameter and

should therefore never be used, while many of the large nuts that often measure up to 5 inches or over in diameter, contain very thin "meat." Old trees produce smaller nuts than young ones, but nuts for planting should not be selected from the first crop.

(*c*.) *The copra should be thick*. Ripe nuts should always be examined to ascertain the thickness of the "meat." The value of the nut depends upon the quantity of copra and oil it produces.

(*d*.) *The thickness of the husk*. Many of the very large-husked nuts are deceiving, because their size depends mainly upon the thickness of the husk. The unhusked nut is often quite small. Again, the thin-husked varieties often contain long nuts of small diameter.

(*e*.) *The hardiness of the tree*. This is a point that must never be overlooked. Evidence is being collected which indicates that certain varieties are the best suited to certain soils and conditions, while there are indications that some varieties are capable of withstanding extremes of weather conditions better than others, and it is possible that some kinds are more resistant to disease than others. Evidence is being gathered on this last point, and this factor should not be overlooked by planters.

THE VALUE OF FORESIGHT.

From the above, it will be seen that any nut picked up or any plant found growing is not necessarily "good enough" to plant. The success of any undertaking depends greatly upon the foresight displayed in the early stages. Why growers are prepared to throw away handsome profits for the want of care and the enterprise that will spend an extra dollar or so at the beginning, cannot be understood! In agriculture—no matter what crop—the planting material should always be of the *best*. Otherwise, good results cannot be expected. It has been indicated above how the *best* is to be procured; from which it can be gathered that the most suitable nuts for planting purposes are likely to be medium-sized round nuts with a medium to thin husk and a thick "meat," borne on healthy trees giving regular, satisfactory yields.

Everyone has heard of San Blas and other well-known grades of nuts, and often it is asked: "Should we not import nuts for planting purposes?" The reply to the large grower is "Certainly for experimental purposes provided you are certain of your source of supply," but to the small grower who cannot afford to experiment,

experience seems to indicate that the reply must be in the negative. The Department of Science and Agriculture has imported several different kinds of nuts that have been recommended in the East and in the West, and has compared them with specially selected colony nuts. Although only a few nuts of each kind were experimented with, the indications at the present time seem to show that the locally selected nuts are the more suited to the soil and climatic conditions of the colony, especially on the heavier lands. It is suggested, in view of the above, that planters, who contemplate planting up areas of the heavier coastal lands with coconuts, should select their nuts from trees that are giving good yields of large nuts on the heavier soils, but it would be well for large growers to import some nuts from various localities for experimental purposes over a fair area when the value of the different kinds can be compared.

Only ripe nuts should be used for planting purposes. Immature nuts should never be planted. In some countries, only dropped nuts are used for planting purposes, but ripe nuts picked from the trees and lowered by means of a rope so that the embryos or "germs" of the nuts are not injured, give more uniformly good results. In fact, the germination results of "picked" nuts is generally better than of "dropped" ones. In picking, however, there is the danger that properly mature nuts are not always gathered. This is a matter that is easily overcome by experience, and picking is generally to be recommended. The nuts at the end of the branches cut for planting purposes are usually unsuitable and should not be planted.

NURSERY-BEDS.

After the seed-nuts have been picked they should be kept for three weeks to a month in a dry place, before they are planted into the Nursery. Nursery-beds are usually made in partial shade and not infrequently at the edge of a plantation of growing trees. The young plants thrive better when lightly shaded than when planted in the open. The nursery beds should be well made up and adequate drainage must be provided. The soil should be well forked, and a small quantity of farmyard manure dug in if it is available. The nursery beds should run across the permanent beds of the cultivation, and should not be more than 1 rood wide. If the soil is heavy, an admixture of ashes should be made.

THE RIGHT WAY TO PLANT THE NUTS.

As indicated in this *Journal* Vol. 1, page 11, the right way to plant coconuts is *on the side* and not *on the end.* Not only do the

nuts germinate better when they are planted on their sides but the resulting plants make quicker growth. It is often asserted that "cockles" attack plants from horizontally planted nuts oftener than those planted vertically, but this has not been our experience. The nuts should be laid in rows, spaces of 2 to 3 inches being left between the nuts in the rows and spaces of 6 to 8 inches between the rows. A mixture of soil and ashes should then be sprinkled over the nuts, until they are just covered, and finally a layer of rice straw or dry grass, 2-3 inches thick, placed over the whole. From 130 to 150 nuts should be planted for every 100 plants required, in order to allow for non-germination and for weakly plants. Watering should be done regularly, and special attention must be given to this operation in dry weather, when the watering should be done at least every other day. Weeds should also be removed as they make their appearance. In Trinidad, it is not uncommon to plant leguminous plants—cow peas, Bengal beans, etc.,—in the nursery beds immediately after the coconuts are put in. These plants make a covering which tends to keep the nuts damp, and therefore the addition of a layer of rice straw or dry grass is unnecessary. They also help to keep down weeds.

When the nuts have sprouted and young leaves appear, the covering of rice straw or grass or of cover plants should be removed, and the nursery beds kept clean of grass and weeds.

After the young plants have grown for some time, the weaker and smaller ones should be taken out and discarded, in order that more room may be available for the vigorous ones.

PLANTING INTO THE FIELDS.

The land chosen should be thoroughly cleaned of all weeds, the drains properly dug and the beds thoroughly forked. Good drainage is absolutely necessary for coconuts, and on the heavy lands of this colony drainage must receive very careful attention.

After drainage has been arranged, the land should be lined out for planting. It is of importance that coconuts be not planted too close together. A distance of 2 roods x 2 roods planted "in quincunx" (*i.e.*, the plants in one row being opposite the middle of the spaces between the plants of adjacent rows) should be the closest allowed. Distances of 2 roods x $2\frac{1}{2}$ roods and of $2\frac{1}{2}$ roods x $2\frac{1}{2}$ roods have much to recommend them in some localities, especially on the lighter soils.

Some of our farmers have experienced difficulties with the distances recommended for planting different crops, but with coconuts it is only necessary to take two full-grown leaves and to place them end to end so that they touch but do not overlap. A young plant can safely be put in at each end of this "line" of two coconut leaves.

A large area of the lands now being planted with coconuts is abandoned cane land and the beds are already laid out, three roods wide. On such lands the rows of plants should be 2 roods apart, and the plants in the rows $2\frac{1}{2}$ roods apart. The plants should be put in quincunx, so that while one bed will have two rows of plants on it, the rows being $\frac{1}{2}$ rood from the drains, the adjacent beds will contain only single rows along their centres.

After the beds have been lined out, specially prepared holes should be made with the fork. These should be at least three feet square and two feet deep. They should be left open for some time, and when planting is to be done, they should be filled with broken up surface soil.

Transplanting should be done during rainy weather. Plants taken from the nursery beds should be of fair size, and should possess a certain amount of stem. Small plants should not be put out. They should be left for a further length of time in the nursery beds. The plants should be taken from the nursery beds with as little injury to their roots, as possible and they should be put into their permanent positions in the fields without delay. If the weather is dry after transplanting has taken place, watering should be done if it is possible, and water should be let into the drains.

AFTER-CULTIVATION.

During the first two or three years catch crops of provisions can be grown between the coconuts, provided they are not planted too close to the plants. If provisions are not grown, it might be desirable to plant leguminous plants such as Bengal beans, woolly pyrol, *Canavalia* spp., *Tephrosia* spp., and *Crotalaria* spp. as cover crops. Weeding expenses may by this means be reduced.

There is a tendency in this colony to allow coconuts, after they have been planted out, to become ruinate. This is an exceedingly bad policy and is economically ruinous. Coconuts should be weeded at least once a year, and circular spaces of $\frac{1}{2}$ rood diameter around the plants should be kept clean by weedings every three

or four months. The weeds cut down should be used as mulch or else forked in. General forkings are necessary once a year in heavy soils for the first three or four years, and give beneficial results, for the more thorough the cultivation the sooner the plants come into bearing. The forkings should not be too close to the plants but in the cleared circular spaces periodical mulchings and vertical forkings are of benefit.

The drainage must receive attention every year. The coconut is generally a shallow-rooted plant and *must* have good drainage. The drains must be kept clean of all weeds and grass, all shallows thrown out, and they must be dug periodically. Coconuts pay handsomely for liberal treatment, and the output has been doubled on some plantations as the result of careful attention to drainage and cultivation.

After the plants are four years old, forking of the beds should be limited to the spaces in between the rows of plants. The fallen leaves can be cut up and trenched in when this is done. The area of land forked is diminished as the trees become older and larger, but occasional forkings should be carried out as long as possible.

After about six years, coconuts require but little cultivation. Drainage must be attended to, weeds and bush cut down and used as mulch, while fallen leaves and husks should be collected and 'trenched' in shallow trenches in the spaces between the rows of plants. Coconuts respond to dressings of farmyard or other organic manures and give greatly increased yields. In some localities phosphatic and potassic manures may give beneficial results.

YIELDS.

When good cultivation is given to coconuts they commence to bear between the fifth and eighth years of growth, but if they are neglected or closely planted, returns will not be obtained before the tenth to twelfth years. Average returns, under good cultivation, should be obtained in the sixth or seventh years. In young trees, the nuts may be cut down by means of a grass knife on a bamboo pole, but immature nuts are often gathered by this method. With older trees, the "picker" ascends the trees and cuts the nuts down by means of a cutlass. Only experienced pickers should be employed in order to assure that only mature nuts are cut. Immature nuts produce less quantities of oil than mature ones; they produce a poor grade of copra, and spoil a shipment of nuts. Skill is necessary to pick only mature nuts, and this operation must

receive careful attention. Enquiries made some years ago from various coconut planters in the colony elicited the information that an average of 80-100 nuts per tree per annum were obtained. Later information confirms these figures where careful cultivation is practised, but the general average for the colony is less than 80. This is due to the lack of attention to cultivation and drainage. Most of the coconuts in the colony at the present time receive no attention beyond the picking of nuts, and the average yields could be greatly increased by proper attention.

The percentage of "selects" in the colony nuts is very low. This is due to previous lack of care in selection of planting material, to too close planting, and also to neglect of cultivation. Why should this colony's percentage of "selects" be only about 20, when other countries obtain between 60 and 80? The difference between the price of select nuts and that of culls is the difference between $24 and $12-14 on the New York Market, and what an addition to profits would be made if the plantations produced 60% instead of 20% "select" nuts. Yet this can be done by proper selection of seed-nuts, by care in planting at good distances apart and by thorough cultivation and drainage.

COCONUT PRODUCTS.

Nuts:—An increasing number of nuts are being exported, chiefly to New York. During 1911 the exports amounted to 1,038,000; in 1908 to only 200,000. Only "select" nuts should be exported, as smaller nuts can, as a rule, be more profitably turned into copra or oil than sold as "culls." The comparative value of nuts, copra, and oil should be worked out for each estate, and should be used as a guide by the manager in the disposal of its products. In Trinidad it has been ascertained that 275 to 300 nuts give 100 lbs. of copra or 5 to 6 gallons of oil. Returns vary on each estate, according to the quality of the nuts produced and to the machinery employed.

Copra:—Copra is the commercial term for the dried kernel of the coconut. Increased interest has been taken in copra manufacture in the colony during the past two or three years. There are two grades of copra acceptable to the market, (1) the fine grade used for edible food-products and (2) the ordinary grade used for oil purposes (largely in soap manufacture). The fine grade has not yet been prepared in the colony, as coconut planters have not yet put in up-to-date artificial driers. For the production of the fine grade,

care should be taken that the pieces are as uniform in size as possible and that the drying is thorough and uniform. In some colonies it is possible to produce this fine-grade copra by sun drying, but this could not be generally practised here. The ordinary-grade copra is manufactured in the colony, being mainly sun-dried; but artificial driers of local manufacture have been erected, and it is possible that in the near future better equipped machines may be introduced.

Nuts must be kept for some weeks after they have been picked before they can be used for the manufacture of copra or oil. Unripe nuts give a poor grade of copra, with a low oil percentage, and they turn mouldy more rapidly than ripe nuts. When unripe nuts are picked they should be made into copra by themselves and not mixed with the bulk of the nuts.

The nuts are broken in a variety of ways and the "meat" is removed after partial drying has taken place. The copra is put into the sun until thoroughly dry. In the wet season, it is difficult to dry it thoroughly and the process is not sufficiently rapid to prevent moulds developing. Mouldy copra is of low value.

There are various forms of artificial driers which can be recommended to turn out a high grade of copra. The copra is dried quickly, has a superior appearance, and is possessed of better keeping qualities. For the successful manufacture of copra on a comparatively large scale, in a climate such as that of this colony, artificial driers are essential and should prove very profitable investments.

In all artificial driers, it must be borne in mind that the copra is to be dried by hot *dry air*, and that the ventilation of the drying chamber is of primary importance. The use of heat in these driers is to *dry the air* and not to heat the copra. Several driers that we have seen constructed, directly *heat* the copra, and the ventilation is sadly neglected. Such driers cannot produce satisfactory results.

Oil:—The majority of the coconuts produced in the colony are used for the manufacture of oil for local consumption. This manufacture is largely carried out in a very crude manner by small growers. The copra is grated by hand on a rotary grater, and is then boiled in open coppers. Hand presses are sometimes used for removing the oil from the meal. It is unnecessary to emphasize that low yields are obtained by this method, that an enormous amount of waste takes place, that the oil has poor keeping quali-

ties, and that the cost of production is relatively high. There are some oil plants in the colony in which the copra is reduced to a fine state of division by proper crushing mills and where hydraulic presses are used for squeezing out the oil. These plants are not up-to-date and the returns are not what they should be. It is anticipated that if up-to-date oil machinery were introduced much better returns would be obtained and the investment would be profitable.

There is no refining of the oil done in the colony, but it is commonly settled or strained.

Coconut Meal:—The residual meal left after the oil has been extracted is a first-class cattle food, and in well-equipped factories the value of the meal covers the cost of manufacture of the oil; and yet, how much of this valuable by-product is thrown away on the coconut plantations of the colony? Rather than throw it away in heaps, as is commonly done at present, when it has a certain manurial value, if properly distributed, it should be scattered about the plantation. But why should this product be thrown away when it has a high food value, and, through the live-stock, has a high manurial value for the plantation?

PESTS AND DISEASES.

In the earlier stages of growth, "cockles" cause a certain amount of damage. These "cockles" are the small black hardback (*Dyscinetus bidentatus*). The beetles attack the plants usually about the level of the ground or a little below it. They usually cause the most damage in cultivations that are neglected and overgrown with bush. "Cockles" can only be guarded against by keeping a careful watch on the young plants. When round holes are observed in the ground near the sprouting nuts a careful examination should be made. "Cockles" are generally to be found where these round holes are seen, and should be sought for by digging or by pouring water down the holes. They must be collected and destroyed.

The larger palm borer (*Strategus alveus*, Fabr.) also occasions some damage to seedlings in the nursery and to young plants in the fields. Their presence is also detected by the holes and excavations near the plants and they must be collected in a similar manner to that given above for cockles.

Scale insects affect coconuts, more especially in the young stages. If cultivation is properly carried out and drainage attended to,

they do not occasion much damage and can easily be kept in control by spray compounds.

Beetles are responsible for the loss of many trees throughout the colony. The commonest beetles are the Palm Weevil (*Rhyncophorus palmarum* Linn), the bearded weevil (*Rhina barbirostris*), small weevil borers (*Metamasius hemipterus*) and Ambrosia Beetles. They occasion damage by destroying the tissues in or near the hearts of the tree and cause the death of many trees. They attack plants of all ages but they can be controlled by the practice of proper sanitary methods in the plantations. All trees destroyed by beetles should be cut down and burned. The trees should be " junked " up and piled into heaps with dead leaves, grass, etc. These heaps should be fired, and if the stems are not properly destroyed, they must again be collected and burned. Beetles are always the most prevalent in plantations that allow old stems, all the old leaves, etc., to be left lying about the plantation, and where grass and bush is allowed to luxuriate.

The coconut caterpillar (*Brassolis sophorae*) causes damage by denuding the plants of all their leaflets. Such trees lose their young nuts and do not bear full crops for another eighteen months. The caterpillars, if in large numbers, cause considerable damage. They live, however, during the daytime in "nests," formed by joining the edges of the leaflets together by means of light-brown threads, and therefore the simplest and best remedy is to cut down these nests and destroy their contents. The destruction of these nests should be part of the routine work of coconut cultivations, but it is generally sadly neglected.

Bud-rot disease is common in some parts of the colony and does some damage. This disease is a very complex one. The first symptoms are non-setting of flowers, dropping of young nuts, and the gradual yellowing of the leaves, until finally, the whole bud is involved in a vile soft rot. The cause of the disease is as yet unknown. It is probably bacterial in origin, and the investigations of Mr. J. R. Johnson, of the United States Department of Agriculture, in Cuba and other countries, are of interest. He asserts that the disease is caused by *Bacillus coli*, but his evidence is insufficient and the results of his infection experiments inconclusive. The problem is a very difficult one and further researches will have to be made. One of the worst attacks of typical bud-rot we have seen in this colony caused the death of hundreds of palms in a few weeks, whilst in the coconuts growing just the other side of the

dam (not 5 roods away from the badly diseased section) but growing under better conditions of cultivation and drainage, not a single tree was lost. Bud-rot is always worst in badly neglected cultivations, and especially where the drainage is not satisfactory. In well kept plantations it is rarely to be found. There is no known cure for bud-rot, and therefore, when it once makes its appearance, steps must be taken to keep it in check. The sanitary con. dition of the cultivaticn must receive attention. All affected trees must be cut down, the leaves cut off and allowed to dry for burning the stems, while the diseased buds should be buried, preferably with lime. To prevent bud-rot spreading, it must be tackled as soon as it makes an appearance. It is useless to wait until hundreds of trees are destroyed, and it is also essential that the cultivation and drainage of the estate should be properly attended to.

In the Mahaicony district of the colony a fungus disease of the nuts is occasioning a certain amount of damage. It is very common in properties where the cultivation and drainage is neglected. Steps should be taken to eradicate this disease by destroying all affected nuts. The nuts are attacked at all stages of their growth. They present greyish dried-up patches on their sides or ends, and later, small black fungus spots make their appearance. If the nuts are attacked while young they do not mature, and if later on, they only partially develop.

Root disease of coconuts is common in some districts of Trinidad and is also to be found in this colony especially on the heavier lands. The first symptoms closely resemble those described for bud-rot, and the root disease is often mistaken for it. But the buds are quite sound while all the roots are rotten and the stems discoloured red. Subsequenty the buds become involved in a soft rot that closely resembles bud-rot. All affected trees should be cut down and destroyed, and supplies not put in for some time afterwards. Drainage should also receive attention for there is no doubt that a very large number of the coconuts lost in this colony (it is generally asserted through one disease or another) owe their death to improper or faulty drainage.

J. B. HARRISON.

F. A. STOCKDALE.

The Crops on the Experimental Sugar-Cane Fields, 1911.

THE crops grown on the Experimental Sugar-Cane Fields were reaped in December 1911 and January 1912 with the general results shown in the following notes :—

YIELDS OF VARIETIES.

AVERAGES FOR PLANTS AND RATOONS.

The yields of the varieties may be conveniently compared with those of some Bourbon canes growing on land which had not been under Bourbon for many years. The average yields and characteristics of the expressed juices of the varieties under the various conditions of manuring used in the large plot series of trials were as follows :—

VARIETIES: MEAN YIELDS, ETC.

		Juice.		Saccharose in Juice.	
Variety.	*Tons Canes per acre.*	*Per cent. of canes.*	*Specific Gravity.*	*Lbs. per gallon.*	*Tons per acre.*
D118	24.3	66.9	10813	1.835	2.78
216	22.5	72.5	10787	1.804	2.67
145	19.4	66.7	10848	2.022	2.41
419	19.4	66.1	10825	1.913	2.38
625	21.6	64.5	10729	1.735	2.36
294	18.7	67.3	10812	1.940	2.26
721	21.0	67.4	10783	1.712	2.25
651	19.8	63.2	10820	1.901	2.21
642	15.9	66.5	10753	1.784	2.21
4395	18.1	69.5	10735	1.611	2.18
317	19.6	69.7	10760	1.700	2.16
504	18.4	68.0	10762	1.762	2.05
420	19.7	65.0	10772	1.709	2.03
44	18.3	65.6	10775	1.767	1.97
167	18.0	61.8	10797	1.854	1.91
139	17.3	64.6	10810	1.795	1.85
281	15.8	67.6	10800	1.862	1.84
357	15.6	67.3	10792	1.830	1.78
177	14.8	64.4	10802	1.860	1.76
4399	16.4	66.0	10781	1.708	1.71
333	16.2	60.0	10810	1.833	1.65
638	15.5	61.4	10786	1.856	1.64
604	12.6	65.3	10855	2.060	1.56
433	17.3	58.7	10742	1.635	1.54
398	16.9	63.3	10652	1.558	1.54
405	15.7	61.1	10704	1.662	1.48
4397	14.8	67.5	10690	1.520	1.39
Bourbon	12.8	68.7	10800	1.854	1.37
293	12.9	63.9	10735	1.710	1.31
4407	12.2	65.6	10758	1.695	1.26

Nos D490, 338, 246, 76, 154, 58, 335, 305, 426, and 454 each gave returns which were equivalent to less than 1.25 tons of saccharose in their juices per acre, their returns thus being lower than that of the Bourbon—1.37 per acre.

Of more direct interest to planters are the relative yields of the varieties under what may be considered as normal nitrogenous manuring for British Guiana—300 lbs. of sulphate of ammonia per acre :—

VARIETIES : YIELDS, ETC., UNDER NORMAL MANURING.

		Juice.		Saccharose in Juice.	
Variety.	*Tons Canes per acre.*	*Per cent. of canes.*	*Specific Gravity.*	*Lbs. per gallon.*	*Tons per acre.*
D419	28.5	66.1	10832	1.940	3.37
651	27.7	63.2	10820	1.923	3.11
118	26.4	66.9	10823	1.877	3.07
216	24.3	72.5	10830	1.884	3.06
625	26.7	64.5	10874	1.704	2.72
145	21.1	66.7	10870	2.097	2.71
642	23.5	66.5	10775	1.856	2.69
44	24.3	65.6	10760	1.782	2.64
721	25.0	67.4	10760	1.631	2.55
294	20.7	67.3	10820	1.978	2.54
638	23.8	61.4	10780	1.827	2.49
167	23.0	61.8	10850	1.986	2.46
317	22.3	69.7	10768	1.681	2.46
504	20.8	68.0	10788	1.801	2.37
4397	22.9	76.5	10730	1.640	2.36
139	21.2	64.6	10815	1.822	2.31
398	23.2	63.6	10650	1.651	2.29
420	22.9	65.0	10760	1.645	2.28
281	17.4	67.6	10840	1.962	2.13
333	20.2	60.0	10806	1.880	2.12
D4395	20.2	69.5	10740	1.598	2.09
433	22.0	67.4	10740	1.577	1.90
375	16.8	67.3	10780	1.775	1.86
405	19.5	61.1	10750	1.671	1.85
604	13.9	65.3	10890	2.141	1.78
177	16.1	64.4	10810	1.853	1.77
4407	16.5	65.6	10780	1.759	1.76
293	14.9	63.9	10790	1.827	1.61
76	14.0	66.6	10770	1.770	1.53
Bourbon	12.1	68.7	10820	1.914	1.48

The following varieties each gave less than 1.5 tons per acre of saccharose in their juices : Nos. D338, 490, 246, 426, 154, 58, 4399 305, 335 and 454.

AVERAGES FOR PLANT CANES.

The following regords the yields of varieties cultivated as plant canes which under conditions of normal manuring each gave yields in excess of 1.5 tons of saccharose per acre in the expressed juices :—

YIELDS OF CANES AND OF SACCHAROSE IN THEIR JUICES.

	TONS PER ACRE. Mean Results.		Yields under Normal Manuring.	
Variety.	*Canes.*	*Saccharose*	*Canes.*	*Saccharose.*
D118	24.2	2.71	27.6	3.13
721	21.0	2.25	25.0	2.55
651	19.8	2.21	27.7	3.11
317	19.6	2.16	22.3	2.43
625	21.5	2.14	28.5	2.85
4399	18.4	2.01	20.4	2.23
167	18.0	1.91	23.0	2.46
139	17.3	1.85	21.2	2.31
333	16.2	1.65	20.2	2.12
604	12.6	1.56	13.9	1.78
293	12.9	1.31	14.9	1.61
490	11.6	1.23	12.6	1.32
246	11.7	1.17	13.2	1.32
76	10.8	1.12	14.0	1.53

Nos. D154, 58, 335, 305, 426, and 454 produced yields less than 1.5 tons of saccharose in the juice per acre.

Averages for Ratoon Canes.

The yields of the varieties cultivated as ratoon canes were as follows :—

YIELDS GF CANES AND OF SACCHAROSE IN THEIR JUICES.

	TONS PER ACRE. Mean Results.		Yields under Normal Manuring.	
Variety.	*Canes.*	*Saccharose.*	*Canes.*	*Saccharose.*
D 118	24.4	2.81	25.2	2.98
216	22.5	2.67	24.3	3.06
625	21.6	2.47	26.6	2.78
145	19.4	2.41	21.1	2.71
419	20.4	2.38	28.5	3.37
642	15.9	2.21	23.5	2.69
4395	18.1	2.18	20.2	2.09
504	18.4	2.05	20.8	2.37
420	19.7	2.03	22.9	2.36
44	18.3	2.97	24.3	2.64
281	15.8	1.84	17.4	2.13
357	15.6	1.78	16.8	1.86
177	14.8	1.78	16.1	1.77
398	16.6	1.54	23.2	2.29
433	17.3	1.54	22.0	1.90
405	15.7	1.48	19.5	1.85
4399	14.5	1.45	13.4	1.31
4397	14.8	1.39	22.9	2.36
4407	12.2	1.26	16.5	1.76
388	10.8	1.23	12.7	1.43
Bourbon	6.6	.71	8.2	1.00

As in 1910, the results of growing under identical conditions of manuring D625 in rows six feet and five feet apart respectively were of interest. The mean results were :—

6 foot rows ..	..	.. 20.6 Tons of canes per acre.
5 foot rows ..	..	.. 24.6 ,, ,, ,, ,,

It appears advisable on the heavy soil of the Experimental cane fields to plant canes in rows 5 feet apart in preference to 6 feet.

D118 as in 1910 gave very satisfactory results. On the soil of the Expermental fields it is a cane of high resistent power to drought resembling in this respect D145.

RAINFALL AT EXPERIMENTAL FIELDS, 1911.

The rainfall as recorded at the Experimental Fields during the year 1911, the average monthly rainfalls on them during the ten years 1900-1910, and the differences of the rainfalls during 1911 in excess of or in deficit from the average monthly rainfalls, are shown by the following :—

	1911	Averages 10 Years 1900–1910	Difference from Averages
	Inches.	*Inches.*	*Inches.*
January ..	11.09	8.60	+2.49
February ..	6.32	6.25	+ .07
March ..	13.50	9.29	+4.21
April ..	9.16	7.50	+1.56
May ..	9.96	11.99	—2.03
June ..	10.19	12.03	—1.84
July ..	9.54	9.69	— .15
August ..	3.35	7.69	—4.34
September ..	.38	3.79	—3.41
October ..	2.07	2.45	— .38
November ..	2.35	5.31	—2.96
December ..	2.20	11.49	—9.29
Total ..	80.11	96.08	—16.07

The year was characterised by rainfalls in excess of the average of the previous ten years in the months January to April. From May to July the monthly rainfalls were lower than the average, whilst from August onward the sugar-cane suffered at first from insufficient rainfall and later from very severe drought.

ROTATION OF VARIETIES.

Owing to the meteorological conditions during the year having been unfavourable in the extreme to the growth of Bourbon canes on the very heavy clay land of the Experimental Fields, the trials with rotation of Bourbon and other varieties were unsatisfactory. The mean results work out as follows :—

	Tons of canes per acre.
Bourbon after fallow (20 years)	12.8
,, ,, Bourbon (20 years) ..	11.8
,, ,, Seedlings (10 years; Bourbon 8 years	11.5

The higher yield on the fallowed plots amounts to 8.6 per cent. of the mean yield of the non-fallowed plots. As the probable error in this comparison of 21 fallowed plots with 28 non-fallowed is somewhat less than 2 per cent., it is clear that the yields on the fallowed land were normally in excess of those on the non-fallowed. But the yields on the fields continually under Bourbon and on those on which Bourbon canes had been followed for 12 years by seedling varieties were within the limits of probable error of the trials and hence are inconclusive.

EFFECTS OF MANURING.

NITROGENOUS MANURES.

The beneficial effects of these manures were clearly apparent with all the varieties under trial. The mean returns with normal and high manurings—300 and 450 lbs. of sulphate of ammonia respectively—were as follow :—

			Tons of Canes per Acre.		
Fields.	*Canes.*		*No. Nitrogen.*	*Normal Nitrogen.*	*High Nitrogen.*
South	Plants	..	3.7	11.2	..
,,	Ratoons	..	11.7	20.0	24.0
N. East	Plants	..	8.1	15.4	..
,,	Ratoons	..	10.3	21.3	21.9
N. West	Plants	..	14.2	22.6	..
,,	Ratoons	..	14.0	23.4	..
Averages :—	Plants	..	11.3	19.2	
	Ratoons	..	11.7	21.4	22.8

In 1911 the rainfall during the first four months of the year was far too heavy for plant canes, to which it proved more or less disastrous in the earlier stages of their growth. This ended with a sudden cessation of the rains early in August and was followed by an intense drought during the latter months of the year.

Owing to the above-mentioned meteorological conditions during the year, many varieties of canes, especially those growing as plant canes, were unable to make full use of the heavy dressings of nitrogen. Their periods of active growth enabled them, as will be seen by the above averages, to make satisfactory use of manuring equivalent to 300 lbs. of sulphate of ammonia per acre, but were

either not long enough or not under sufficiently favourable conditions to enable them to fully utilise the higher quantities.

VARIOUS SOURCES OF NITROGEN.

The comparison of the action of nitrate of soda and of sulphate of ammonia applied in equivalent proportions of Nitrogen—60 lbs. per acre—gave the following mean results :—

	TONS OF CANES PER ACRE		
Fields.	*No. Nitrogen.*	*Nitrate of Soda.*	*Sulphate of Ammonia.*
South	8.8	15.5	17.9
North West	13.0	14.1	21.6
North East	6.5	8.5	16.4
Mean	9.4	12.7	18.6

As in 1910 and in several other years, the manurial value of nitrate of soda proved to be much lower than that of sulphate of ammonia. This was doubtless largely due to the trials being on very heavy clay land and to the meteorological conditions proving more unfavourable to the action of nitrate of soda than to that of sulphate of ammonia. At the same time this year's experience has added another to the already numerous proofs that the sugar-cane shows a distinctive preference for ammonia as its source of nitrogen over nitrates.

Comparisons were obtained as to the relative action of nitrate of soda and of sulphate of ammonia on soils for some years continuously manured with these substances. The mean results were as follows :—

	TONS OF CANES PER ACRE.	
	After Nitrate of Soda.	*After Sulphate of Ammonia.*
Nitrate of Soda (60 lbs. nitrogen)	16.2	15.3
Sulphate of ammonia „ „	17.2	15.6

These results are not altogether in accordance with those of the preceding crops. As in 1909, the results of nitrate of soda on lands long treated with nitrate of soda and with sulphate of ammonia respectively, were practically the same, the differences being within the limits of probable error, whilst in the earlier trials dressings of sulphate of ammonia on lands long manured with nitrate of soda gave distinctly better results than did the repetition of the nitrate.

The results of applying sulphate of ammonia after nitrate of soda and after sulphate of ammonia respectively were almost exactly the opposite to these obtained in 1909; the means of the two crops being 18.8 and 18.2 tons of sugar-canes per acre respectively. It appears that alternation of sulphate of ammonia with nitrate of soda has been advantageous, but not for more than three successive crops.

Comparisons of sulphate of ammonia, nitrate of soda, nitrate of lime, nitrolim (calcium cyanamide) and dried blood as sources of nitrogen, when applied in repeated dressings and in proportions in each case equivalent to 60 lbs. of nitrogen per acre, were made on the North-West field with the following results:—

(*a*). Comparisons of sulphate of ammonia, nitrate of lime, and nitrolim; mean results with 15 varieties of canes each in duplicate and triplicate plots.

TONS OF CANES PER ACRE.

No Nitrogen.	*Sulphate of Ammonia.*	*Nitrate of Lime.*	*Nitrolim.*
14.3	22.9	17.3	17.2

(*b*). Comparison of sulphate of ammonia, nitrate of lime, nitrolim, and dried blood; mean results with 3 varieties of canes each in duplicate and triplicate plots.

TONS OF CANES PER ACRE.

No. Nitrogen.	*Sulphate of Ammonia.*	*Nitrate of Lime.*	*Nitrolim*	*Dried Blood.*
13.6	25.5	15.1	13.9	14.6

(*c*.) Comparisons of sulphate of ammonia, nitrate of lime, nitrolim and nitrate of soda; mean results with 3 varieties of canes each in duplicate and triplicate plots.

TONS OF CANES PER ACRE.

No. Nitrogen.	*Sulphate of Ammonia.*	*Nitrate of Lime.*	*Nitrolim.*	*Nitrate of Soda.*
13.0	21.6	15.3	13.6	14.1

These comparative trials having been made during two years only—years the meteorological conditions of which were unfavourable for the action of the nitrates, and during which possibly the constant state of saturation of the soil for some months after the

application of the manures followed by an intense and prolonged drought acted adversely on the dressings of nitrolim and dried blood—it is not desirable to draw deductions from them as regards the effects of nitrate of lime and of nitrolim.

NITROGEN WITH POTASH AND PHOSPHATES.

For some years past data have been accumulating pointing to a possible injurious action of any excess of soluble salts in the manures applied to cane cultivation on heavy clay soils. In connection with this the following mean results of trials of sulphate of ammonia without and with sulphate of potash and superphosphate of lime may be of interest :—

TONS OF CANES PER ACRE.

		Sulphate of Ammonia.		
	No Nitrogen.	*200 Lbs.*	*400 Lbs.*	*500 Lbs.*
Without Potash & Superphosphates	6.7	13.9	20.2	19.5
With Potash & Superposphates	9.6	14.0	21.0	19.2

These indicate the following as the gains due to the nitrogenous manurings :—

TONS OF CANES PER ACRE.

	200 Lbs.	*400 Lbs.*	*500 Lbs*
Without Potash& Superphosphates	7.2	13.5	12.8
With Potash & Superphosphates	4.4	11.4	9.6

It is evident that as in the crop of 1909 and in several of the preceding crops the addition of sulphate of potash and superphosphate of lime to the manurings of sulphate of ammonia has not been advantageous.

EFFECTS OF MANURING WITH PHOSPHATES.

A very large number (116) of comparative trials with and without superphosphate of lime were made. In 80 of these increases ensued

on the application of phosphates. The mean results are as follows :—

FIELDS	TONS OF CANES PER ACRE.		
South			
Plant Canes.		*No Phosphates.*	*Superphosphate.*
Plots without Nitrogen		6.2	7.0
Plots with Nitrogen ..		13.7	11.8
Ratoons			
Plots without Nitrogen		10.9	12.6
Plots with Nitrogen		22.0	22.4
North East			
1st Series.			
Plots without Nitrogen		7.4	8.1
Plots with Nitrogen		15.4	16.6
North East			*Slag*
2nd Series	*No Phosphates*	*Superphosphate*	*Phosphate.*
Plots without Nitrogen	12.8	12.1	13.9
Plots with Nitrogen	18.7	19.3	21.6

The increases due to the addition of phosphates to manurings were not remunerative. One of us pointed out the minor importance of phosphates in the manurings of sugar-cane as long ago as 1886 ("Sugar Cane," Vol. XIX., pp. 136, 198 and 199) and this fact was earlier demonstrated by trials made in British Guiana in 1883 and 1884 ("Timehri" Vol. III, 1884, pp. 138 and 145.)

EFFECTS OF APPLICATION OF MOLASSES TO THE SOIL.

Through the kindness of the Hon. R. G. Duncan we were able to make a series of comparative experiments on the alleged beneficial action of applications of vacuum-pan molasses to soil on which sugar-cane is being cultivated. Forty-nine duplicate plots not cross-dressed and cross-dressed with molasses were used for the investigation. Twenty-one of these received molasses at the rate of 100 gallons per acre, fourteen at the rate of 200 gallons, and fourteen at that of 300 gallons. Molasses given to us by Mr. Duncan was used. It had the following composition :—

Water	23.5
Saccharose	29.8
Glucose	32.0
(1) Mineral matters	5.9
(2) Undetermined Organic matters ..	8.8
	100.0

(1) Containing phosphoric anydride	..	.21
(1) ,, potash	.. .. ..	.20
(2) Containing nitrogen	.. .. ..	.18

The specific gravity of the molasses was 1.40 at 30° C.

Details of the applications were as follows :—

PER ACRE.

Molasses applied. *Gallons.*	*Lbs.*	*Sugars.* *Lbs.*	*Phosphoric anhydride* *Lbs.*	*Potash* *Lbs.*	*Nitrogen.* *Lbs.*
100	1,400	860	2.9	2.8	2.6
200	2,800	1,730	5.8	6.7	5.1
300	4,200	2,590	8.7	8.6	7.6

The mean results of the 49 plots not cross-dressed and cross-dressed with molasses were as follows :—

TONS OF CANES PER ACRE.

	Yields.	*Probable error : excess or deficit.*
Without molasses	14.5	.5
With molasses	14.9	.5

The above results indicate that the molasses exerted no appreciable action. Hence its application resulted in a financial loss of from about $5 to $15 per acre, according to the quantity of molasses applied.

On 9 plots which did not receive any application of nitrogenous manures the returns were somewhat lower where molasses was applied than where it was not applied—8 tons and 8.9 tons of canes respectively. On the plots which were manured with sulphate of ammonia the following results were recorded :—

TONS OF CANES PER ACRE.

	Yields.	*Probable error : excess or deficit.*
Without molasses..	16.3	.6
With molasses	17.1	.6

The apparent increases were within the limits of probable error of the trials.

On the plots manured with nitrate of soda the mean returns without and with molasses were identical—15.2 tons of canes per acre in each case.

Hence, in the year 1911, the general results of the trials give no support to the allegation that the application of molasses to the soil is beneficial to its yield of sugar-cane. But whilst on the five series of plots consisting of 35 without molasses and 35 plots on which molasses was applied at the rate of 100 and 200 gallons per acre, the mean returns of the plots cross-dressed with molasses were lower than those of the corresponding plots which did not receive molasses, on two series of 14 plots without, and 14 plots on which molasses was applied at the rate of 300 gallons per acre a mean increased yield of 1.6 tons of canes per acre was obtained on the latter of them. This increase is greater than the range o error expected on 14 duplicate trials—.9 ton of canes per acre in excess or deficit—but is not so high as to indicate decisively a favourable action of the molasses. Assuming the increase to be due to the application of that substance, it is but very little higher than the increase in yield—1.0 ton of canes per acre—which should be due to the nitrogen contained in the molasses if that nitrogen was as effective as was nitrogen in the normal manurings of 60 lbs. of sulphate of ammonia used on the field. In fact, the increased yield that might be claimed as due to the application of 300 gallons per acre of molasses would be obtained by a dressing of 50 lbs of sulphate of ammonia per acre. Assuming that the 1.6 tons of canes per acre would yield 400 lbs. of total sugars in the juices expressed from them, it does not appear to be either financially or agriculturally a satisfactory procedure to apply, in round figures, 2,600 lbs. of sugars to the soil with the result of getting back 400 lbs.

About 50 examinations were made in each case of the juices of the canes grown without and with molasses. The mean results of the analyses were as follows :—

	Specific Gravity.	*Lbs. per gallon Saccharose*	*Lbs. per gallon Glucose*	*Quotient of Purity.*
Without molasses	1.0817	1.9308	.1147	86.9
With molasses	1.0831	1.9457	.1164	86.15

The quality of the juice was not beneficially affected by the application of molasses to the soil.

THE SUGAR CONTENTS OF THE JUICES OF VARIETIES OF SUGAR-CANES AND OF NEW KINDS RAISED FROM THEM.

The following shows the mean contents of saccharose in the juices of the Bourbon canes and of 16 varieties raised from its seed as determined in the large field experiments :—

RELATIVE SUGAR CONTENTS OF BOURBON AND ITS SEEDLINGS.

Bourbon.	1.854
D604	2.060
651	1.901
281	1·862
638	1.856
338	1.856
490	1.835
216	1.804
305	1.792
642	1.784
721	1.712
293	1.710
4399	1.708
317	1.700
4399	1·695
4395	1.611
4397	1.520

Two of the seedling varieties yielded juice distinctly richer in saccharose than was that of the Bourbon, the juices of four were practically similar to it, whilst the juices of ten of them were distinctly lower in saccharose than was that of the parent kind.

In the case of D 625 and varieties obtained from its seed, the results were .—

RELATIVE SUGAR CONTENTS OF D 625 AND ITS SEEDLINGS.

D625	1.735
D419	1.913
118	1.855
167	1.854
333	1.833
44	1.765
420	1.709
405	1.662
76	1.659
335	1.577

Here the juices of five of the seedling varieties were distinctly richer in saccharose than was the juice of the parent cane D 625, whilst four were of lower strength.

THE PREVALENCE OF DISEASE AMONG THE VARIETIES.

The prevalence of fungoid diseases chiefly of rind fungus (*Colletotrichum falcatum* type) among certain of the varieties under trial are shown grouped under their parentages in the following :—

PERCENTAGE OF TOTAL NUMBER OF CANES DISEASED.

Bourbon.		*Meligeli.*		*Red Ribbon.*	
Bourbon ..	26.1	D625 (Plants)	2.3	D504	6.5
D4399 (Plants)	11.0	,, (1st Ratoons)	7.0	145	5.7
4399 (Ratoons)	13.1	,, (Old ,,)	10.0	58	.3
4407	10.2	167 (Plants)	2.2	*White Transparent*	
338	9.5	,, (Ratoons)	6.8	D.357	7.1
281	7.8	420	4.7	398	4.4
216	7.3	335	4.6	426	3.0
294	6.9	405	2.8	454	.3
4395	4.4	118 (Plants)	.8		
4397	3.5	,, (Ratoons)	2.6		
624	3.0	76	2.3		
305	2.7	44	2.3		
721	2.5	419	2.0		
317	2.2	333	1.4		
490	2.1				
638	2.0				
293	1.2				
604	.6				

The most noticeable points in the above are that the suscepti-bility of the Bourbon cane to fungoid attacks is far in excess of that of any other variety now under cultivation on the Experimenta Fields ; that its seedling varieties D 4399 and D 4407 are also subjec to a marked extent to these attacks ; and that whilst D 625 as plan canes and 1st ratoons was fairly resistent, as older ratoons it wa almost as susceptible as were the two above-mentioned varietie of Bourbon seedlings.

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Yields of Varieties of Sugar-Canes: Crops of 1911.

REPORTS were received from 25 plantations as to their crops of Bourbon canes during the year 1911. The yields reported varied from 1.01 ton to 2.30 tons of commercial sugar per acre, the mean return working out at 1.57 ton. These reports were all from areas of more than 20 acres each.

Thirty-four plantations reported their results with D 625, and of these 31 estates had recorded the crops of areas of more than 20 acres each of that cane. The extremes of all the returns were .90 ton and 2.66 tons of sugar per acre, the mean being 1.70 tons. On the areas of over 20 acres each of the extremes were 1.25 and 2.66 tons, the mean working out at 1.73 tons.

Twenty-six plantations reaped D 145 cane, its mean return on all areas planted being 1.73 tons of sugar per acre, whilst the mean return on 18 plantations where areas of more than 20 acres each were reaped was 1.76 tons. On the whole of the trials the extreme yields were .83 and 2.32 tons per acre, whilst on the latter they were 1.20 and 2.50 tons.

Results were reported by 26 estates on B 208 cane, the extremes being .88 and 2.36 tons of sugar per acre whilst the mean return was 1.69 tons. Nineteen of the plantations reaped areas of more than 20 acres each of these canes, the extreme yields reported by them being 1.26 and 2.36 tons, whilst the mean yield was 1.74 tons of sugar per acre.

D 109 was reaped on 26 plantations, 19 of which had areas of over 20 acres of it. The maximum of all returns recorded was 2.20 tons of sugar per acre, the minimum returns being .93 ton, whilst that of large areas was 1 ton. The means were 1.48 and 1.45 tons of sugar per acre respectively.

Nine plantations returned B 147 as being under cultivation, and five of them had more than 20 acres of it. On all trials the extremes were .76 ton and 2.71 tons, whilst on the larger areas they were 1.58 and 2.10 tons. The mean yields were 1.74 and 1.77 tons of sugar per acre respectively.

The White Transparent cane was cultivated on four plantations, two only having areas greater than 20 acres of it. Its extreme yields were .82 and 2.10 tons of sugar per acre, its mean yield

on all the plantations being 1.37 tons, whilst on those reaping more than 20 acres each of it, it was 1.79 tons.

Returns of the results yielded by B 376 were received from nine plantations, on three of which it had been cultivated on areas of over 20 acres. Its yield varied from 1.19 to 2.00 tons of sugar per acre, being from 1.26 to 1.80 tons in the larger trials. The mean yields were 1.54 and 1.61 tons respectively.

D 4,397 was reaped on six estates, its yields varying from 1.45 to 2.00 tons of sugar per acre ; the mean return was 1.77 tons.

Green Transparent was reaped on four plantations, its yields being returned as 1.35 tons the minimum to 2.51 tons, the maximum, the mean working out at 1.93 tons of sugar per acre. On two estates it was cultivated on larger areas, the yields being 2.10 and 3.51 tons of sugar per acre with a mean return of 2.30 tons.

Diamond 185 was returned as producing on three estates, from areas of over 20 acres each, a mean yield of 2.03 tons of sugar per acre, its lowest and highest yields being 1.69 and 2.26 tons respectively.

The following shows the minimum, maximum and mean yields of certain other varieties :—

		Yields of tons of sugar per acre.		
Canes.	*No. of Trials.*	*Minimum.*	*Maximum.*	*Mean.*
D 3956	4	.93	2.40	1.61
B 109	3	1.50	1.70	1.61
Sealy	3	.83	1.99	1.43
D 74	2	1.70	1.92	1.81
D 116	2	1.40	1.84	1.62
D 95	2	1.00	1.86	1.43
B 1566	2	1.15	1.55	1.35
D 135	2	.81	1.80	1.30

Many varieties were reported upon each of which had been reaped on a few acres only. The yields of the following of them were worthy of record :—

Canes.	*Acres reaped.*	*Yield of Sugar. Tons per acre.*
B 3412	3	4.21
P 6	5	3.47
Diamond 382	22	3.32
P 2	3	3.25

(Continued.)

Canes.	Acres reaped.	Yield of Sugar Tons per acre.
D 130	16	2.62
B 1529	3	2.20
D 199	5	2.08
D 419	1	2.07
D 4395	1	2.00
Diamond 399	82	1.96
D 72	4	1.90

Last year's data confirmed earlier experience that certain of the new varieties when cultivated over large and widely distributed areas, are capable of giving yields 12 per cent. in excess of that of the Bourbon.

The areas reported on of each of the principal varieties were :—

Variety.	Acres.
Bourbon	12,789
D 625	11,303
B 208	7,933
D 145	3,366
D 109	2,492
Diamond 185	656
B 147	415
White Transparent	414
Green Transparent	260
B 376	137
D 4397	35

AREAS OF VARIETIES OF SUGAR-CANE FOR CROPS OF 1912.

Reports have been received from 40 plantations which show that 38 plantations have 23,669 acres occupied by D 625; 32 plantations have 8,812 acres of B 208; 29 plantations have 4,618 acres of D 145; 27 have 2,548 acres of D 109; 13 have 657 acres of B 147; 5 have 593 acres of Green Transparent, and 6 have 203 acres of White Transparent, whilst on three plantations 808 acres are occupied by Diamond 185.

The area occupied by D 625 is 1,997 acres in excess of that under that cane in 1910; an increase of 236 acres is shown by D 145; one

of 105 acres by Diamond 185 ; and one of 98 acres by Green Transparent ; whilst the following varieties show decreases in area :—

Variety.	*Decrease.*
B 208	719 acres
D 109	713 „
B 147	97 „
White Transparent	48 „

The following varieties are also being cultivated in areas of over 100 acres each :—

Variety.	*Area.*	*Increase.*
B 376	176 acres	——
D 4399	148 „	8 acres.

46,341 acres are now occupied by canes other than the Bourbon as compared with 45,385 during 1911, the increase being equal to 2.0 per cent.

The area occupied by the Bourbon cane has been reduced from 24,252 acres in 1911 to 22,403 acres for the crops of 1912. Thus 67.4 per cent. of the land under sugar-cane on sugar estates is cultivated in varieties other than Bourbon.

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Foresight and Coconuts.

The industrial progress of the South Sea Islands does not attract much attention there, as the trade is with Australia in first place, but it is noteworthy. Not very long ago their chief and generally only value was in the deposits of phosphates, and in fact a great number of them were brought under the British flag by the grant of licences to work these. A vast amount of discussion took place from time to time as to how the Crown could secure a fair rent or royalty, and, considering that, as a rule, no one but the discoverer knew anything about the value of the deposits, and supervision was hardly practicable, the problem was a difficult one ; but one good and far-sighted provision was made whenever practicable by requiring the licensee to plant coconut trees.

—" The Colonial Office Journal " : Jan., 1912.

Areas and Yields of Rice: Crops of 1911.

THE returns received from the District Commissaries show that during the year 1911, 36,000 acres were cultivated in rice, the total yield being 748,400 bags of paddy or at the rate of 20.8 bags per acre. In 1910, 31,680 acres yielded 608,250 bags or 19.2 bags per acre. There was therefore in 1911 an increase of 4,320 acres and of 140,150 bags of paddy as compared with the returns of the previous year.

In round numbers 4,400 acres were returned as having been under cultivation with rice during the spring crop of 1911. Their return was 81,000 bags or at the rate of 18.4 bags to the acre.

J.B.H.

F.A.S.

Catching the Cacao Beetle.

Those who have read Mr. P. L. Guppy's "Life History and Control of the Cacao Beetle" (Board of Agriculture, Trinidad, Circular No. 1) will be interested to hear of the number of beetles recently caught by the use of traps recommended by him. Mr. H. Hutton, of El Recobro estate, Caroni, writing one September 18, says that:

"On August 22, while inspecting a field that was being lightly pruned I noticed several cacao beetles, and in a couple of hours had caught 19. This led me to believe that they must be fairly numerous, and a man was then sent off to cut some trapwood "Chataigne Maron" (*Pachira aquatica*) which is recommended by Mr. P. L. Guppy in his very valuable work on the subject as a good bait. Next day as a result 108 beetles were captured, and since then the daily catch has ranged between 60 and 500. To-day the total number caught for 26 days is 5,324 which works out at a average of 204 per day. This is the work of one man whose duty it is to set traps and catch the beetles so the cost has been very little."

Writing again on September 25, he says :—

"The last six days catch of beetles, with the same man catching, etc., has yield 2,117, an average of 352 per day. This brings the total to 7,441."

—"Bulletin Department of Agriculture, Trinidad and Tobago," December, 1911.

Cacao Experiments. 1911.

During the year 1911 the returns of cacao from the manurial experiment fields at Onderneeming School Farm were as follows :—

Yields of Wet Cacao or " Pulp " per Acre.

Plots.		Lbs. Per Acre. *Yields.*	Lbs. Per Acre. *Probable error : excess or deficit*
Nos. 1, 4, 7, 11 and 16	No Manure	1,164	40
Nos. 3, 8 and 13	Heavily mulched	1,514	48
Nos. 12 and 18	Sulphate of Ammonia only	1,104	80
Nos. 6 and 14	Superphosphate of Lime and Sulphate of Potash	1,612	103
Nos. 5,10 and 15	Superphosphate of Lime and Sulphate of Ammonia	1,446	148
Nos. 2 and 17	Superphosphate of Lime, Sulphate of Potash and Sulphate of Ammonia	1,398	177
No. 9	Sulphate of Potash and Sulphate of Ammonia	1,266	127

These returns are equivalent, on the assumption that the " pulp " yields 36.6% of its weight of cured cacao, to the following :—

Yields of Cured Cacao.

Plots.	Lbs. per Acre. *Yields.*	Lbs. per Acre. *Probable error : excess or deficit*
Nos. 1, 4, 7, 11 and 16	426	15
Nos. 3, 8 and 13	563	18
Nos. 12 and 18	404	29
Nos. 6 and 14	590	38
Nos. 5, 10 and 15	529	54
No. 9	643	46
Nos. 2 and 17	512	65

During the year the mean yields on the mulched plots and on those receiving superphosphate of lime and sulphate of potash only have been practically the same. The manuring with superphosphate of lime and sulphate of ammonia, with sulphate of potash and sulphate of ammonia, and with superphosphate of lime, sulphate of potash and sulphate of ammonia produced little or no increases which under the conditions of the trials could be safely ascribed to the manuring, whilst the application of the purely nitrogenous manure—sulphate of ammonia—although adding to the apparent vigour of the trees resulted in yields differing but little from the mean yields of the unmanured plots.

During the years 1909, 1910, and 1911 the total crops of wet cacao have been as follows:—

		Lbs. per Acre.	
Plots.		*Yields.*	*Probable error: excess or deficit*
Nos. 1, 4, 7, 11 and 16	No Manure	3,622	126
Nos. 3, 8 and 13 ..	Heavily mulched	4,814	154
Nos. 12 and 18 ..	Sulphate of Ammonia only	3,470	294
Nos. 6 and 14 ..	Superphosphate of Lime and Sulphate of Potash	4,528	212
Nos. 5, 10 and 15 ..	Superphosphate of Lime and Sulphate of Ammonia	4,162	372
No. 9	Sulphate of Potash and Sulphate of Ammonia	3,827	340
Nos. 2 and 17 ..	Superphosphate of Lime, Sulphate of Potash and Sulphate of Ammonia	4,159	85

These correspond to the following :—

Plots.	Lbs. Per Acre. Yields.	Probable error : excess or deficit
Nos. 1, 4, 7, 11 and 16	1,304	45
Nos. 3, 8 and 13	1,733	55
Nos. 12 and 18	1,249	106
Nos. 6 and 14	1,630	76
Nos. 5, 10 and 15	1,498	134
No. 9	1,378	117
Nos. 2 and 17	1,497	31

These results show that the highest yield of cacao during the three years has been on the heavily mulched plots, on which there has been a minimum increase of about 330 lbs. of cured cacao or about 110 lbs. per acre per crop over the mean yield of the non-manured plot. But the cost of the mulching to produce 330 lbs of cacao, worth, say $40, has been at least $50

On the other hand the application of sulphate of potash and superphosphate of lime, costing approximately $10 during the three years, has given a minimum increase of 205 lbs. of cacao, worth, say $24.

The quick-acting nitrogenous manure—sulphate of ammonia—has lessened the yields both when applied to otherwise unmanured land, or added to manurings of superphosphate of lime, and sulphate of potash.

The application of lime to the land has not had any effect, the weight of wet cacao produced on the 18 plots of limed land during the three years, having been 4,116 lbs. per acre as compared with 4,084 lbs. per acre yielded by the 18 plots of not limed land.

J. B. H.
F. A. S.
S. H. B.

Lessons with Plants in British Guiana.

IV.

[" *It is finding answers to questions which chiefly deserves to be called Science* "—L. C. MIALL, F.R.S., in " Teaching and Organization."]

THE FLAMBOYANT AND ITS FAMILY.

(Continued.)

LET us now turn to some other members of the great Natural Order of which the Flamboyant is one of the most ornamental members. One very common plant in gardens—it varies in size from a large shrub to a small tree—is the " Doctor Doodle " or " Barbados Pride." Its long inflorescences bearing buds at the top, pretty yellow or orange red flowers in the middle, and pod-like fruit below shoot up here and there all over Georgetown, New Amsterdam and in the villages wherever a humble gardener or amateur horticulturist loves an easily grown and showy plant which will give a bright blaze of colour. For our purpose, which is rather scientific than artistic, the plant affords an interesting subject for examination and an easy one. We need not repeat here the directions we have already given ; the methods we used for the Hibiscus and Flam boyant can be applied to the Barbados Pride, and many points of similarity between it and the Flamboyant, and some striking differences, will reward the painstaking student. Particularly would we draw attention to the calyx and to the mode of dehiscence of the fruit. The inflorescence is worth noting as it is the best example we have come across yet of the *raceme*—a flowering branch in which the stalked blossoms are progressively younger as we approach the growing point. Certain small scale-like pointed bodies at the base of some of the flower stalks or *pedicels* in the Flamboyant may have caught your eye and will have been easily interpreted as bracts or modified leaves in the light of our previous experience. We have learnt to expect buds, including flower-buds, in the axils of leaves of many kinds. As for the fruit of the Barbados Pride, what shape does it assume when the pod has burst, and how many seeds do you find still adhering to the burst pod ? If the full number is wanting, what do you imagine has happened to those that are missing ? The different methods—dodges almost,

some of them seem to be—by which seeds are distributed with the result that the seedlings do not compete too severely with the parent plant are always an interesting and important point in the biology of the plant.

THE POD OR LEGUME.

The characteristic fruit of the great group of plants we are now studying—the pod or legume—deserves a special notice for it is the structure which botanists after a long study have decided upon as the most constant feature of the order. Let us recall for a moment the chief points about it as we have observed them in the last two flowers we have been studying. The fruit is very obviously developed from a simple ovary which is *superior*—that is to say its position in the flower is such that all the other whorls are developed below it, *i.e.*, between its base and the flower stalk—and it consists of a single carpel, as can be shown by cutting it across, when but a single *cell* will appear. Compare this with the transverse section you made and drew of the ovary of the Hibiscus. A longitudinal (lengthwise) section will show a number of ovules arranged in a row; in some pods as the fruit grows older distinct (in some cases woody) divisions appear but these are merely partitions in the carpel and do make the carpel more than one. The pod, then, is a superior, one-celled, one or many seeded fruit usually dehiscing by both *sutures* or seams so as to form two *valves*, and bearing its seeds or seed on the ventral suture. In the language of Botany, the monocarpellary ovary has two sutures, one which corresponds to the union of the margins of the blade of the carpellary leaf and is turned towards the axis of the plant, and another which corresponds to the mid-rib of the blade and is directed towards the floral envelopes or the circumference of the flower: the former is called the ventral, the latter the dorsal suture. The face of the flower turned towards the stem is called the posterior face, that towards the bract the anterior one. Considerable variation exists in pods, and we soon realise that definitions in Botany are not to be understood in a mathematical sense. We cannot too often repeat that it is a hopeless task to try and crowd Nature into a formula.

NEW NOTIONS REGARDING STAMENS AND PETALS.

Taking the pod as our guide let us keep our eyes open and note as many plants as we can which bear this kind of fruit. Our investigation may have interesting results. One tree which can hardly escape our notice has pods which are similar in their dehiscence to

those of the Barbados Pride, although before splitting they may not be nearly so flat. This tree, of which there are several species, rejoices in the name of *Bauhinia* or "Napoleon's Hat." A good specimen grows in the Queen's College yard in Murray Street. The leaves are remarkable both for their shape, which is quite different from that of the other *Leguminosæ* we have studied so far (are they simple or compound ?), and for their habit of folding up tightly along the mid-rib at night—a habit which as we shall see is common to many plants of this order. A walk beneath the Saman trees of Vlissingen avenue or Main Street as evening is drawing in will afford you a striking example of this. The flower of the Bauhinia will present but little difficulty; we are already familiar with the fusion of sepals in the calyx; but what of the stamens ? How many of these structures did you find in the Flamboyant ? How many in the Barbados Pride ? How many do you now find in the Bauhinia ? Remember that the hallmark, as it were, of a fertile stamen is the presence of an anther containing pollen dust. Is it possible that there are such things as infertile or abortive stamens ? By this time we trust you will not be satisfied until you have done your best to solve any problem which crops up by using your own eyes. Look then very carefully at the places where you would expect, after your study of the Flamboyant, to find fertile stamens. What do you find ? Compare the flower of the Mango and of the Tamarind. In the latter the number of petals and of sepals is remarkable, as well as the number of stamens. How many of these organs can you account for ? Is it possible that the unusual number of petals and sepals can also be attributed to *suppression* ? In this way we arrive at new ideas which may help us in interpreting the flowers of the Leguminosæ. For instance, examine the flower of the "Carrion Crow bush": you should now with a little trouble be able to understand all the details of the flower. You may note, by the bye, that if the flowers of the Barbados Pride had no stalks but grew *sessile* on the flowering axis we should have an inflorescence like that of the Carrion Crow bush—which is called a *spike*. The fruit of this plant is *winged*,—hence the name *Cassia alata*—but in how many respects does it conform to our definition of a pod ?

THE THREE TYPES OF LEGUMINOSÆ.

If you now collect specimens of flowers of every pod-bearing plant you see and examine them carefully and try and arrange them in series as you did with the leaves of the Malvaceæ you will find that you can group them under three types—one represented by the

Flamboyant, the Barbados Pride, the Carrion Crow bush, and the Bauhinia; a second corresponding more or less closely to the Saman tree, the "Bread and Cheese" tree, the "Shame-plants" and their spiny relations with pretty little yellow, white, or pink "pompons" of flowers which are common along practically all the dams of the sea coast; and a third which resembles the peas and beans, the indigo (which is to be found in quantity along the railway line) the little "sweethearts" whose broken pods cling so affectionately to one's clothes after a country walk, and the beautiful yellow-flowered "rattle-snake bush" which used to be common along Kelly's dam until wireless telegraphy came and the road fell a victim to the passion for improvement. Where so many differences exist Botanists endeavour to find some character which will remain constant throughout a group or series. It would be worth while trying the experiment of cutting across flowers of all these plants and seeing whether in the arrangement of the floral whorls some such constant character may not be found. With this hint we shall leave you to follow out the lines of inquiry suggested in this article—do not forget to make careful drawings or diagrams of *all* your sections—and hope ourselves to resume this topic in the next number of the *Journal.*

(*To be continued.*)

Duration of Vitality of Para Rubber Seeds.

On the thirty-first of January, a box of 600 Para rubber seeds was packed for a German planter to go to German New Guinea. The seeds were packed as usual in a tin box 12 inches long, 8 inches wide and 5 inches deep, in layers of burnt rice husk, and the box was covered with canvas stitched over it. The planter, however, omitted to leave any address or instructions for shipping the box, as he had intended to do. The parcel remained unopened in the office till the 13th of July (a period of five months and thirteen days) when the lid was taken off and the box left open by a window. By the end of the month 53 of the seeds had germinated and thrown up strong stems. A hundred of the others were removed and put in a pan, and of these three germinated. No particular care was taken of these seeds and it is probable that if they had been carefully treated more would have germinated. The duration of the vitality of these seeds for nearly six months, enclosed in a box, shows that the Para rubber seed has greater lasting powers if properly packed than would be expected. I believe this is the longest record of duration for this seed.

—"Agric. Bull. S. and F. M. S.": December, 1911.

The Present Position of Economic Entomology in the West Indies.

DURING the recent Agricultural Conference held in Trinidad a number of papers were read and discussions held concerning this subject, and from these some idea may be gained of the present position and the progress made during recent years.

A number of economic entomologists were present, including Mr. H. A. Ballou, M.Sc. (Entomologist to the Imperial Department of Agriculture), Mr. F. W. Urich, F.E.S., C.M.Z.S. (Entomologist to the Board of Agriculture, Trinidad) and the Assistant Entomologist, Mr. P. L. Guppy, F.E.S. British Guiana was for the first time represented at these Conferences in Economic Entomology by Mr. G. E. Bodkin, B.A., Government Economic Biologist. The Entomological Research Committee sent their Scientific Secretary, Mr. G. A. K. Marshall, who was able to take the opportunity of outlining the proposed work of this recently formed Committee, and also to suggest lines of co-operation with the various West Indian Colonies. It is to be greatly hoped that his suggestions will receive attention from the colonies concerned. The Committee cannot fail to be of the greatest possible assistance to Economic Entomologists in the course of their work.

The papers of greatest interest were those relating to the Insects of the Sugar Cane and Coconut Palm, by Mr. F. W. Urich, a paper on Parasitic Insects, by Mr. H. A. Ballou, and other papers on the various pests of Cotton by the same author.

SUGAR CANE PESTS.

A good deal of attention has recently been paid to the insects attacking the Sugar Cane in Trinidad. Mr. Urich in his paper made mention of the havoc wrought by the Giant Moth Borer and the Small Moth Borers, Weevil Borers and another pest, the Frog-hopper, which, owing to local conditions, has done considerable damage in Trinidad. A variety of methods have been employed for the control of this insect, including the use of a parasitic fungus and the introduction of a predaceous bug from Mexico.

Despite the large number of insecticides and methods for insect control which have been brought into use during recent years, but few of them can be applied with any reliable results against the Moth Borers. The only hope seems to lie in a systematic removal

of affected canes. The possibilities of natural control, although seeming at present somewhat remote, may in the future prove more efficacious.

COCONUT PALMS.

The insects attacking the Coconut Palm have recently been investigated by the Trinidad Entomologists, and their work has revealed several points of interest. The list includes Weevil Borers, various species of beetles, the larvæ of certain butterflies, and a variety of scale insects. The relation of insects to Bud Rot is also mentioned, any real connection however between the two has yet to be proved. The application of modern principles are in many cases impracticable, though spraying may, under some circumstances, prove beneficial. At all times a careful watch should be maintained over the trees, any signs of disease or insect attack at once receive attention.

Mr. Ballou, in his paper on Parasitic Insects, showed how great the advances of Economic Entomology have been during recent years. He mentioned a variety of pests and their control by means of parasites, one of the most striking of these examples being the control by means of a Chalcid parasite of the Black Scale (*Sassietia nigra*) commonly occurring on a number of economic plants, chiefly cotton, throughout the West Indies. This parasite is easily introduced, spreads rapidly, and is very effective. Mention should also be made of a paper read by Mr. F. W. South, B.A. (Mycologist to the Imperial Department of Agriculture) on the control of scale insects by parasitic fungi. In certain islands in the West Indies these fungi are wholly responsible for the small number of scales to be found attacking economic plants. They may be artificially disseminated under certain circumstances, their chief requirement being a certain amount of humidity which is essential for their spread and existence.

CACAO.

Practical demonstrations in the methods used for the control of the Cacao Beetle in Trinidad were given by Mr. P. L. Guppy. They consisted in the use of simple traps; pieces of wood being placed in different positions on the tree in which the beetles either oviposited or hid during the day. Arsenate of Lead sprayed on to the trees should be used in conjunction with these traps. The control of the Cacao Thrips by means of spraying was also demonstrated.

COLOUR PHOTOGRAPHY.

Mr. Rorer, A.B., M.A., showed how useful records of entomological subjects may be obtained by means of the Autochrome process of Colour Photography.

Apart from the actual sessions of the Conference many interesting discussions connected with economic entomology took place and a scheme of co-operation was drawn up by means of which the entomologists in the different colonies will in the future be enabled to exchange specimens and thus keep in touch with one another to their mutual advantage.

All these papers enumerating the many destructive pests and describing the methods of dealing with them, show very clearly that the fight against insect pests in the West Indies is being maintained with increased energy. As time proceeds the fact is brought more forcibly before all concerned to what an enormous extent insects either directly or indirectly effect the well being of mankind, and how great is the necessity that these should be controlled. Happily this is becoming more generally realised, and measures are more universally being adopted whereby these hordes of insect pests may be checked, and, it is to be hoped, finally eradicated. These remedial measures entail a very thorough knowledge of the life histories of the pests themselves and of the insects living parasitically upon them. It is therefore absolutely essential that these measures involving much painstaking labour on the part of the scientist, should be accompanied by some effort on the part of the practical man. There is now but little doubt that insect attacks are in the majority of cases due to an unhealthy or impoverished condition of the plants themselves. Good, clean cultivation therefore is a *sine qua non*. Further, when a pest appears it should receive immediate attention and not be allowed—as, alas! we too often see—to grow from bad to worse, till finally it gets entirely out of hand and necessitates the employment of drastic and expensive remedial measures.

G. E. BODKIN.

"The Rubber Industry." *

THE official report of the proceedings of the International Rubber Congress, held in London during the second International and Allied Trades Exhibition from June 26th to July 14th, 1911, has recently been published. This report contains the papers read at the Congress and the discussions thereon, as well as the address and speeches made at the Opening Ceremony and at the various receptions and social functions held in connection with the Exhibition.

The papers have been grouped under appropriate sub-heads. Those dealing with the rubber-planting problem as it presents itself in different countries are all collected together in one section, those dealing with the chemistry of rubber latex and rubber in all its forms in another, and those relating to the manufacturing side of the rubber industry in another. They contain valuable information in relation to the rubber industry, and everyone interested in rubber would do well to procure a copy of this work—the contents of which cannot fail to be of interest and value to him. The arrangement of the papers according to subjects is a good one, and makes the book more attractive than was the report of the 1908 Conference.

The following brief notes made at the time of the Conference and in reading through the pages of this book will convey some of the points of particular importance to us, will indicate to growers in this colony the progress that rubber planting, preparation and manufacture is making throughout the world, and should serve to stimulate interest in the volume itself.

FUNTUMIA UNSATISFACTORY.

The Conference was opened by Sir Henry Blake on July 3rd and the first paper that was read related to the experiments with indigenous rubber trees and with rubber cultivation in Uganda. Experimental tappings of mature trees of *Funtumia elastica* growing indigenously in the Uganda forests have given 5 to 6 ozs. of dry rubber per annum while cultivated trees have only given 1 to 2 ozs. The herring-bone system of tapping was adopted, and in re-tapping the new cuts were made 1 inch above the older ones. The pricker was also used. As the result of these experiments

* "The Rubber Industry"—Edited by Dr. Joseph Toney and A. Staines Manders. Published by The International Rubber and Allied Trades Exhibition, Ltd., 75, Chancery Lane, London. Price 15s. 6d. net.

Funtumia elastica is not recommended for planting in Uganda—a country to which it is indigenous—and the general consensus of opinion at the Conference was against the possibility of the successful cultivation of Funtumia. It was also held that if it is planted, it should be planted at distances of 6-10 feet apart.

MANIHOT OR CEARA RUBBER.

The results of experiments with *Manihot Glaziovii* in Uganda were also given. This kind of rubber was introduced through the Royal Botanic Gardens, Kew, 10 years ago and was planted at Experiment Stations and at missions. In many places it has grown rapidly, and is vigorous and healthy. The best results have been obtained with the half herring-bone system, and it has been found that the yield varies considerably in individual trees. This indicates that special attention will have to be paid to seed selection if the best results are to be expected from the cultivation of this plant. In British East Africa the pricker is chiefly used and the rubber is collected as scrap, washed and then crêped. Yields of 3 ozs. of dry rubber per tree per annum have been obtained, while in German East Africa the yields have averaged 4 ozs. In Ceylon, the Ceara rubber grows well, but there has been difficulty in satisfactorily extracting the rubber, and it is suggested that this plant could possibly be successfully treated like the Guyale shrub.

CASTILLOA DIFFICULTIES.

Castilloa elastica does not thrive in Uganda as it is very liable to beetle attacks, and unfavourable results also come from West Africa where it is similarly affected. References were made to the indigenous Castilloas in Brazil and Peru, but no paper dealt with cultivations of Castilloa either in Mexico or the West Indies. The yields of Castilloa have been much less than was originally expected, and the cultivation of this plant, even in Mexico, has not been very successful. A good deal of experimentation has been done with this plant in Trinidad and Tobago, but a suitable tapping system has yet to be found, as cuts heal badly and a continuous method of tapping cannot be practised.

DISTRIBUTION OF HEVEA SPP. IN BRAZIL.

The paper on the Rubber trees and the wild Rubber Reserves of the Amazon by Dr. Huber, the Director of the Museum Goeldi, Para, is a very valuable one. The exact distribution of *Hevea brasiliensis* in Brazil is now gradually becoming known, and the

distribution of species of *Hevea* other than *brasiliensis* is being thoroughly investigated. The hard-cure Para rubber of the Upper Amazon comes from the Acre district of Brazil, the upper Madeira and from the upper Rio Madeira of Bolivia, while the soft-cure hails mainly from the island region of the State of Para in the mouth of the Amazon, including the lower courses of the Xinqu and Tocantins. A form, which is described as being intermediate in qualities between the hard-cure and soft-cure, is said to come from the mainland between the lower Tapajoz and the Madeira. A weak rubber also comes from this mainland from *Hevea collina.* The distribution of *Hevea brasiliensis* in Brazil is therefore summarised as follows :—

(*a.*) On the tide-flooded islands and the shore of the mouth of the Amazon—the trees growing generally on the limit of the regular floods. Tapping in this district has been carried on for over 100 years.

(*b.*) On the middle course of the Rivers Xinqu and Tapajoz, above the first rapids.

(*c.*) In the Brazilian part of the basin of the River Madeira and its affluents.

(*d.*) The Acre Territorium—a country very rich in Para rubber, but in some parts difficult of access.

(*e.*) Along the valleys of the Rivers Purus, Yurua, Yutahy Yarary and Uoayali—*Hevea brasiliensis* in these valleys is confined exclusively to the alluvial bottom lands.

THE DIFFERENTIATION OF HEVEA SPP.

It is suggested that *Hevea brasiliensis* is confined to the lowlands and that the trees growing on the mainlands between the higher reaches of the rivers may prove to be of another species. In this respect Dr. Huber states that Mr. Ernesto Ule, who is investigating the rubber trees of the Acre Territorium, is inclined to the opinion that there are sufficient differences to separate the species of the mainland of the Rio Acre as a distinct one. This is of decided interest and the final report on the rubber trees of this well-known district will be looked for with interest. The distribution of *Hevea benthamiana, H. guyanensis, H. collina, H. cuneata, etc.*, are also alluded to, and remarks made on the quality of their products. *Sapium tapuru* and its rubber and the source of Caucho—*Castilloa Ulei*—are dealt with. The possibility of hybridization between different species of Hevea is men-

tioned and it is suggested that the fact that plantation rubber of the East is, in some respects, inferior to Amazon rubber may have a botanical cause. It was gathered from Dr. Huber's paper and from the discussion afterwards that lack of proper communication was the principal cause of the Amazon rubber-collecting industry not progressing more rapidly. The Government are, however, making roads and helping to build railways, and it is hoped that in the near future some of the rich districts will be opened up. The differences between the shapes of leaves and seeds of *Hevea brasiliensis* were touched upon, and the combination of characters in the leaves and seeds of different species alluded to.

CEYLON PRACTICE.

A valuable paper on the planting and production of Rubber in Ceylon was read by Mr. Kelway Bamber. Practically no change has taken place in the last few years in the methods of planting. At least 100 trees to the acre are recommended for the best results, and a large majority of estates in Ceylon still put in 150 trees by planting 24 feet by 12 feet or 20 feet x 15 feet. Much is being learned about the yielding capacities of different varieties of trees and attention is now being paid to seed selection. Mr. Bamber stated that there are at least three kinds of trees—differing in their bark—in the Ceylon plantations. Two of these yield satisfactorily, but the third, having a thin, smooth, greyish coloured bark, gives practically no latex. It was also stated that with careful tapping of young trees there is a decidedly more rapid increase of girth than if the trees were untapped. There is a tendency to commence tapping when the trees are 4 years old provided that a girth measurement of 15 or 16 inches has been attained.

A NEW METHOD OF TAPPING.

Mr. Bamber also gave a description of a new method of tapping now being experimented with by the Ceylon agricultural authorities. This promises to be of interest to rubber planters in this colony and is described as follows :—Two vertical shallow channels are cut on opposite sides of the tree, and incision cuts are made with special knives at one inch intervals from the tops to the bottoms of these channels—the latex being collected in cups at the base. After missing a day, two other vertical shallow channels are cut 1 inch to the right of the first channels, and incision cuts are made in these as before. This operation is repeated on alternate

days until the whole tree has been encircled and then the trees are rested for six weeks. When re-tapping is commenced, no new vertical channels are made, the old ones being utilised. The incision cuts are now made $\frac{1}{4}$-inch below the first cuts. When the tree has again been encircled with these incision cuts, a further rest of six weeks is given, and then re-tapping is commenced.

The yields compare very favourably with the half herring-bone system and the labour required is considerably less than with the older systems. The proportion of scrap rubber, however, is increased, but if this is collected at once and crêped good prices are realised. This method has only been experimented with for one year but it would appear to be worthy of a trial in this colony.

THE FINANCIAL SIDE.

Mr. Bamber also alludes to the present condition of the industry as an investment, and he estimates that profits, at a low estimate, of £15 to £25 per acre per annum may be expected. When rubber prices drop there are such vast possibilities for its use that over-production need not be feared for many years to come. It is probable that very large areas taken up for rubber will never come into bearing owing to scarcity of labour, not only to plant the trees but to maintain them in a condition to reach a profit-bearing stage. It is also anticipated that several areas taken up for rubber and floated as companies will never give any return.

MISCELLANEOUS.

Other papers deal with rubber in West Africa, Cochin China, Peru and British Guiana and with "The Need of Organisation in the supply of Literature and Labour for Rubber and other Planters" and with "The Maintenance of Health in Rubber-Planting Districts."

Valuable papers dealing with the chemistry and physics of rubber-bearing latices, and with raw rubber testing are also given. The centrifugalization of rubber latex was dealt with by Mr. H. S. Smith, of Tobago, and a brief description given of his machine. This machine separates Castilloa latex easily and experiments have been made with the latices of Hevea and Funtumia.

THE TESTING OF RUBBER.

The paper on Raw Rubber Testing by Messrs. Beadle and Stevens is a particularly interesting one. Chemical analysis is chiefly of value in the case of lower grade rubber other than Para. The

tests for high-class rubbers on which manufacturers rely are physical tests, while in rubber solutions tests are made for adhesive power and viscosity. In the discussion that followed, the question of standardization tests for rubber was brought up. The manufacturers want a uniform product if they can get it, and it was discussed whether some simple tests could not be devised whereby the planter might be able to know what was the quality of the product he was obtaining. The same question was discussed at the meeting of planters, chemists and manufacturers, and it may be seen from the printed details how complex the question really is. The paper read by Mr. Tinnock on "Factors affecting the Valuation of Rubber Shares" deals with many important points which are worthy of attention.

The book closes with an account of the opening or other ceremonies and social functions of the Exhibition and with the results of the several competitions for cups, medals, etc.

F. A. STOCKDALE.

Wood Preservation in the Tropics.

The requirements of an efficient wood preservative in the Tropics may be summarized as follows :—

(1.) It must absolutely protect the timber from termites and other insects, fungus and dry-rot.

(2.) It must be easy of application, either by immersion, painting or spraying, so that woodwork *in situ* can be treated where necessary.

(3.) It must be non-corrosive so as not to affect nails, spikes or other metal work brought into contact with it.

(4.) It must be economical and preferably should be prepared in a highly concentrated form capable of dilution on the spot, to reduce transportation charges to a minimum.

(5.) It must *not* be inflammable, and preferably should be of such a nature as to render the wood more resistant to fire.

Doubtless there are many preservatives aiming at these requirements at present undergoing exhaustive tests in the Tropics, though up to date no one method appears to have met with general acceptance in all quarters.

—"Tropical Life": Sept., 1911.

Growth of Rubber at Issorora, N.W.D.

The following measurements of rubber trees at Issorora Experiment Station taken in February last, are published for general information :—

PARA RUBBER.

	Section D.										
	Bed at foot of Hill.	*Bed No. 1.*	*Bed No. 4*	*Bed No. 6.*	*Bed No. 8.*	*Average.*	*Northern Side-line Parapet.*	*Southern Side-line Parapet.*	*Façade Parapet.*	*Parapets around Sections A, B, C.*	*Mean Average.*
No. of trees ...	31	19	12	41	40	173	29	19	12	98	331
Girth. Inches	10	16	$13\frac{3}{4}$	$10\frac{1}{2}$	$10\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{7}{8}$	13	$11\frac{1}{2}$	$12\frac{1}{3}$

In section D, beds 1, 4 and 6 were planted during the fortnight ended January 18, 1908, and bed 8 during the fortnight ended Feb. 1st., 1908. The Parapets were all planted during the fortnight ended Feb. 15, 1908. All trees, whether originals or supplies, have been measured, and therefore the average of $12\frac{1}{3}$ inches from 331 trees is a true average. There are 77 trees that measure 15 inches or over in girth, of which 45 are in Section D. Tapping experiments are being commenced on these trees. The largest Hevea measured $25\frac{1}{2}$ inches, and the average increase in the girth of the Heveas, in section D, during the year ended Feb. 1912, has been exactly 4 inches.

SAPIUM.

	Section D. Hill Foot Bed.	Section D. Bed No. 1.	Section D. Bed No. 3.	Section D. Bed No. 5.	Section D. Bed No. 7.	Section D. Average.	Northern Side-line Parapet.	Façade Parapet.	Parapets around Sections A, B, C.	Mean Average.
No. of trees ...	29	19	28	37	42	155	28	11	94	288
Girth. Inches	18½	17¾	21	21	21¾	20½	16	13	22½	20½

In Section D, beds 1, 3 and 5 were planted during the fortnight ended Jan 18, 1908 and bed 7 during the fortnight ended Feb. 1st., 1908. The parapets were all planted during the fortnight ended Feb. 15, 1908. The measurements of all trees, whether those originally planted or supplies, have been included in these averages. The largest Sapium measures 33 inches, and the average increase in girth of Sapiums during the past year has been $3\frac{5}{6}$ inches.

MEASUREMENTS OF RUBBER TREES PLANTED ON LATERITIC HILL BEDS.

		Bed 1	Bed 2.	Bed 3.	Bed 4.	Average
Hevea	No. of trees ...	28	25	16	14	83
	Girth, ins. .	8½	7½	9¼	6¾	8
Funtumia	No. of trees ...	16	16	13	4	49
	Girth, ins. ..	12	9	10	8	10
Castilloa	No. of trees ...	20	14	14	3	51
	Girth, ins. ...	12	10	10¾	14½	11¼

The measurements of the trees on the flat lands are satisfactory but the growth of the trees on the hill slopes has been much slower.

The beds in Section D are on flat pegassy-clay lands typical to the North-Western district. They have been well drained and carefully cultivated. One crop of provisions was taken from the land when the rubber was in a young stage, but clean weeding has not been car-

ried out. The beds on the lateritic hill slopes consist of lines 3 roods wide, cut through the forest growth. Weeding has been carefully carried out, but they have received no cultivation. The drainage is natural on these beds.

J. B. HARRISON.
F. A. STOCKDALE

March 1912.

Fresh Air versus Tuberculosis.

"Thus, in districts where all the houses were built on the vicious system known as 'back to back' the phthisis death-rate was 5.2 per 1,000 living; where 56 per cent. of the houses were so built, the rate was 3.6; where 23 per cent. only were so constructed, it was further reduced to 3.3.; and, lastly, where there were no 'back to back' houses—that is to say, where all the houses were provided with some means of light and air both in front and to the rear—the rate was only 2.8 per 1,000. These results are all the more remarkable because, with the exception of the absence of means for thorough ventiliation, the back to back houses on the whole were, in Dr. Datham's opinion, in better sanitary condition than the other houses. Similar results have been obtained by other observers and by Dr. Dana Mair, of the Local Government Board.

"Science," October 20, 1911.

Rat Destruction in Java.

M. D. Kruyff, of the Agricultural Bureau of the Dutch Indies, Buitenzorg, Java, has published an interesting article on the destruction of rats. All visible rat holes were first stopped with earth to ascertain which were inhabited, for the inhabited holes were found re-opened on the following day. Half a spoonful of carbon bisulphide was poured in each of these holes, and after waiting a few seconds to allow the liquid to evaporate, the mixture of vapour and air was ignited. The result was a small explosion, which filled the holes with poisonous gases, and killed all the rats almost instantly. A pound of bisulphide is sufficient for more than 200 rat holes; 131 dead rats were found in 43 holes which were opened after the operation.

—"Tropical Agriculturist" (Ceylon), Oct., 1911.

Species of Mimusops of the Balata Group Found in British Guiana.

FOUR different kinds of balata trees are at present known to exist in the forests of the colony. Of these, the bullet tree and another species called the "Black Balata" are to be found in most parts, the other two species being confined to the far interior. These trees may be briefly described as follows :—

(1.) The Bullet Tree (*Mimusops balata*), already described as yielding commercial balata, the Indian names for which are :—

Tribe.	*Name.*
Warrau	Koberu (Koobi-arri)
Carib	Parata-Eboo.
Arrawak and Makusi	Burué.
Wapisiana and Atorai	Irriarri.

According to Jenman, the tree "reaches at maturity a height of "120 feet* with usually a large spreading head, and a trunk 60 to "70 feet long, and 4 to 5 feet in diameter. The trunk is nearly "cylindrical, and as it does not buttress much at the base, almost "the same size from a few feet above the ground up to the first "branches. The leaves are clustered towards the ends of the "branchlets. They are 4 to 8 inches long, by 2 to 3 inches wide, "ovate-oblong in shape and rounded or apiculate at the end, very "leathery in texture, dark, green above, but from the presence of "a very fine lepidote coating, a bright rusty tint beneath while "young. The flowers spring from among the leaves, are very "small but profusely produced, and the fruit is about the size of a "marble, resembling in taste and character the fruit of the sapo-"dilla or naseberry tree, which belongs to the same Natural Order. "The bark is half-an-inch thick or more, with deep parallel fis-"sures on the outside an inch or so apart, running longitudinally "with characteristic uniformity."

(2.) The "Black Balata" (*Mimusops sp.*), known to the Arawaks as Burué-Karimero (meaning black-burué) or Burué Saleuda (meaning hard-skin burué), also called "Turâr" by the Wapisianas. This tree bears so close a resemblance to (1) the Bullet Tree (*M. balata*) as not to be distinguished from it in appearance, but it differs

* They not unfrequently attain a greater height. I have measured a prostrate tree which at about 15 feet from the base had a girth of 12 feet, 3 inches, the trunk being 94 feet in length to the first branch, and the total height 150 feet.—C.W.A.

from it in the bark, which is harder and thicker, and from which, when cut, milk oozes out in abundance. But the milk is of so thick a nature that it will not flow readily, so that in order to collect it, it must be scooped out of the grooves cut on the trunk. When dried, the latex yields a product known as brittle balata,† which on exposure becomes very hard and brittle and possesses no elasticity or resiliency. It has so far not proved to be of any commercial value.‡

Specimens I have collected of the fruit of this tree are about the same size as those of the true bullet tree, and are like them, also edible, but the difference in the shape of the two fruits provides an easy means of distinguishing these two much alike species from one another. Those of the Black Balata tree are flattened at both ends and of a globose form, while the Bullet tree (*M. globosa* or *balata*) fruits are always oval or egg-shaped. It is interesting to note that these two species are, so far as my observations extend, seldom found associated together, although they are often found growing within the same localities.

As in the case of other species of latex-producing trees, one of which yields a commercial product, while the others do not, the close resemblance of these two species of balata trees is confusing, for in mistaken identity, I have seen in the North West District, black balata trees cut down instead of bullet trees for the purpose of obtaining balata, so that unless acquainted with the characters of this species that can be judged from the ground, prospectors are apt to be misled and to include them amongst the true bullet trees when taking count of the number of these trees in the forest while prospecting.

It must be remembered that if even they were aware of the difference in the fruits, these are not always available for distinguishing between the two species. The black balata trees I have seen were

† An analysis of this black or brittle balata made at the Government Laboratory shewed the composition of this substance to be as follows:

Pure Gutta	32·8 per cent.
Resinous Substances insoluble in Alcohol	35·9 „
Resinous Substances soluble in Alcohol ...	25·9 „
Dirt	5·1 „
Ash	3 „
Total	100·0

‡ The Tauraniro tree (*Humerium floribundum* Mart.-*H. guyanense* Bth.), is known in the Colony as the "Bastard Bullet Tree" and is so called from the resemblance of both its wood and bark to those of the bullet tree. On this account the Tauraniro has been erroneously considered to yield "brittle balata," but the tree has no latex.—C.W.A.

generally widely scattered and of immense size, or, at any rate, much larger than the average size bulle trees. Mr. H. P. C. Melville tells me that they are plentiful in the forests on the head waters of the Essequibo River, where the Indians utilise the dried latex as a cement coating for securely fastening iron points to arrows and hooks to fishing lines.

INTERIOR SPECIES.

From specimens of their leaves furnished me by Messrs. Melville and Ogilvie, the two different kinds of balata trees found in the interior both appear to belong to the genus Mimusops. The Wapisiana Indian names for these trees and other particulars concerning them as supplied me by Mr. Melville are as follows :—

(3.) *Wechibi.* This species grows in the belts of woodlands on the mountain sides and ravines of the hinterland savannahs, and is found in most abundance in forests of this kind on the sandstone table-lands in the vicinity of the Korona Falls on the Ireng River. It is said to yield latex in small quantities only, and the fruit is described as being much smaller than those of the bullet tree, edible, and ripening to a dark purple colour.

(4.) *Iwikush.* This tree is found in the forests of the upper Rupununi River. The latex is said to be very sticky—resembling bird lime. The fruit is described as being about the same size as that of the bullet tree, green in colour when ripe, and edible. The leaves are said to be similar to those of the bullet tree, but the colour of their lower surfaces is white instead of bronze.

C. WILGRESS ANDERSON,
Forestry Officer.

The Price of Willows for Cricket Bats.

To pollard a willow destroys its value as timber suitable for batmakers, who, for maiden growth, will pay very high prices. Dr. A. Henery, of Cambridge, informs the writers that the selling price of cricket-bat willow timber on the ground often reaches 14s. per cubic foot, and may even be higher. He also quotes an actual sale of a lot of trees, averaging 10in. in quarter-girth, and each estimated to yield three rows of crickets-bats, at £3 11s. per tree. The produce from a pollard tree can only be used for fencing purposes ; moreover, the head harbours all kinds of noxious insects, and wet and frost soon destroy the heart of the trunk.

"Journal of the Board of Agriculture," (Eng.) Oct., 1911.

Are Droughts Beneficial?

ARISING out of a statement by Mr. C. F. Doubtreband, of Sydney, that "Droughts are Australia's Salvation" (says the "Farmer and Settler," N.S.W.), there has been an animated discussion in the Press concerning the pros and cons of the drought problem, and many interesting statements have been made on both sides It is matter of common observation that after a droughty period the rains furnish fattening grasses which quickly get stock into condition again; and pastoralists who have been able to pull through the dry period have found that the rise in prices, together with the speedy conditioning of their sheep, has quickly placed them in a position almost if not quite as as good as they were in before the drought. To the smaller man a drought is a calamity, for he cannot last until the recovery takes place, and the bank reaps all the benefit.

Mr. Victor Green (Sherleys, Limited) contends that all the blessings of a drought may be obtained without ruinous cost; that in fact the principal benefit is the spell given to the land, and that this rest for the soil is a part of the regular routine in advanced flock and crop farming. The crop grower calls it fallowing; and every up to date farmer knows that with fallowing, rotation of crops, and fertilising he can use his land perpetually, improving it all the time, and never needing either a drought or a flood to bring it into heart again. The drought, the flood, the bush fire—these are Nature's ways; but they are very slow, and man has improved on them. The good farmer can get along very well without droughts, and when they come, the good farmer, again, is never so hard hit as his less thorough neighbour—for the well-tilled farm is practically drought-proof.

PHOSPHATE BETTER.

Mr. Green wrote:—"Your 'authority' on the blessings of droughts is not likely to find much support either from pastoralists or agriculturalists—the people who have to fight the disastrous dry spells which, fortunately, have been conspicuous by their absence for the past few years. I cannot speak of the effect on the wool industry, not being sufficiently acquainted with its ramifications, but would just remark that drought is not necessary to sweeten the grass on pastures, for it is well-known that the application of phosphate fertilisers has that effect, and in addition creates a better growth, capable of supporting a large number of stock.

"Doutreband says, 'Soil must get a spell somehow, and droughts give it a spell.' So does fallowing, which, besides cleaning and aerating the soil by frequent working, leaves it in such a condition as to make it retentive of moisture. I would also point out that a long drought makes the soil so hard that the ploughs cannot be used until rain falls, but in the normal season, fallowing can be done with the best of results as affecting the next crop or two.

"There can be little doubt that a perfect system of fallowing, rotation of crops, and the use of superphosphates has quite changed the position of wheat farmers, and made their calling a safe instead of a precarious means of livelihood; for it has been proved beyond doubt that good crops can be, and have been, raised under the driest conditions by good farmers, who realise the wisdom of frequent working of the soil and scientific application of fertilisers. Perhaps Mr. Doutreband can convince wheat farmers that it is better for them to be ruined (as many were by the 1902–3 drought) than to make big money, as they have been doing during the past three years. Let him go into the wheat belt and try.

THE CASE OF NEW ZEALAND.

"Crops extract from the soil minerals such as phosphoric acid and potash. Surely no man will say they are restored to the soil by a spell. I would suggest that your correspondent study the reports of the Rothamsted experiments, which show a maintenance of fertility on soil continuously cropped or grazed for over forty years. There are no droughts there, and yet the crops and stock are as good as ever. Mr. Doutreband mentions his residence in New Zealand. Well, a month's dry spell there is regarded as a great misfortune. New Zealand farmers know the great possibilities of continuous cropping and grazing under up-to-date methods, one of the vital principles of which is the correct use of fertilisers.

"Are New Zealand sheep and cattle deterioriating in quality because there is no drought? No; the New Zealand sheep farmer feeds his pastures, and so assures his stock obtaining an abundance of good sweet grass. I cannot believe that droughts benefit New South Wales, and look to progressive methods of agriculture to increasingly improve the position it can attain by fallowing, rotation, and fertilising. I do agree that the absence of provision to conserve water and the burn-

ing of straw and grass are blots on our rural methods, and hope for better things in these directions."

"Queensland Agricultural Journal" Dec., 1911.

The Preparation of "Loofahs."

The vegetable sponge belongs to the same order—*Cucurbitaceæ*—as the melon, pumpkin, cucumber, etc. It grows freely in Queensland, and bears heavy crops. There does not appear to be a great sale for them in the State, although many are sold in the chemists' shops.

Under the name of "Loofah,' it grows and fruits freely in many tropical countries. The botanical names of the plant is *Luffa Ægyptica.* The method of preparing the sponges for market is thus described in the "Agricultural Journal of the Cape of Good Hope":—"The fruits should be allowed to remain on the vines until they have acquired a yellowish tint, but not until they have begun to assume a brown colour, as this indicates that the outer skin of the gourds is undergoing decay, which will cause the fibrous structure within to become discoloured. The fruits should be cut from the vine with about 2 inches of stem attached, for convenience of hanging. They should be hung in an airy, draughty shed for two or three days, and the outer skin will then be found to be fairly soft and pliant; this stage of the preparation is assisted by cutting off the tip of the gourd at the lower end, leaving a small hole through which the contained moisture may drip. The loofahs may next be removed by running the finger down the skin of the fruit on one side, splitting it open, and turning out the loofah, which is at once thrown into a washing vat containing lime water (5 lb. of slaked lime to 60 gallons of water). The loofahs are stirred about the lime water for a few minutes, and then removed to a draughty shed to dry. Care should be taken to shake the lime water out of each loofah before drying. If the loofahs are dried too quickly, they are apt to become brittle and crack; they must not, however, remain damp too long, or they may become mouldy, though the lime prevents this to a large extent, and is, indeed, used in order to protect them from fungoid growths. When the loofahs are dry, the seeds may be easily shaken out of them by hand, and when this is done they are ready for the market."

—"The Queensland Agricultural Journal," October, 1911.

Reviews of Books Received.

"TROPICAL HYGIENE."

By A. H. Kirby, B.A. (Cantab.)

Only those practically engaged in the teaching of Tropical Hygiene can appreciate the difficulties and disappointments of the task. It is uphill work, truly; and the passive opposition one meets with comes in many cases from those to whom one would look for helpful sympathy at least, if not active assistance. The advocate of modern ideas is regarded too often as a faddist, an impractical enthusiast, a pestilent fellow who would turn the world upside down to no good purpose. It is small wonder, then, that Mr. Kirby, in the preface to the capital little work before us, reminds his readers that the present generation has learned as much as it can, and that his remarks are designed for minds that are still pliable. The comfort of the teacher lies in the knowledge that what he has to impart will benefit new and future generations.

In his treatment of the subject, Mr. Kirby recognizes two grades of pupils, and divides his book into two parts—the first dealing with the Rules of Health, and designed, by the simplicity of language used, for junior classes; and the second, treating of Common Diseases, their Causes and Prevention, which is intended to suit senior scholars. The author has carefully kept in the foreground the necessity for experimental work—one of the most difficult points in teaching the subject—and he warns the schoolmaster that his book is intended as a guide only and not as a "reader." We suggest, as an excellent test of the proper use of the book, the application of the sentence "the teacher must not, however, be satisfied with the practical work that is detailed here; his own experience and surroundings will indicate other experiments that may well be added." The Original Experiment, here hinted at, is the rarest fruit of the tree of knowledge as it is grown to-day in the yard of the local school.

While the language used by Mr. Kirby is very simple it is often of the happiest. The author has the knack of compelling attention by a phrase. What could be better than "Such people are helping to kill one another while they sleep," in reference to the shutting up of bed-rooms at night? Moreover, his advice is always sound and well put, whether it deals with houses or food, clothing or mosquitos, specific disease or general sanitation. We should have liked

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perhaps, a greater insistence on very early notification in the case of yellow fever: the curious details of transmissión of the disease require that: and some simple illustrations would have added to the appearance of the book. Perhaps we shall see these added in a later edition. Meanwhile we welcome the publication, congratulate Mr. Kirby heartily, and wish his efforts, in all sincerity, God-speed.

A. L.

"INSECT PESTS OF THE LESSER ANTILLES."

By H. A. Ballou, M. Sc.

During the recent Agricultural Conference held in Trinidad we were presented with a small book entitled "The InsectPests of the Lesser Antilles." The author, Mr. H. A. Ballou, M.Sc., Entomologist on the Staff of the Imperial Department of Agriculture, is to be congratulated on the production of a work which is certainly a much needed step in the right direction.

During recent years the Imperial Department has issued a number of bulletins connected with matters entomological and these have been embodied together with further information on the same subject in the present work. The book is written in "popular" style, thereby losing some of its value as a guide to the practical treatment of insect pests. It should, however, stimulate considerable interest in entomology among planters and others engaged in the cultivation of the soil.

As Mr. Ballou points out it is not possible within the scope of such a small book to give an account of all the injurious insects in the West Indies; attention has therefore been paid to the more important ones, a very complete list ofwhichappears. The book is perhaps as little overcrowded with illustrations, many of the reproductons from photographs being distinctly poor and nothing would be lost by their omission. It is essential in all entomological publications that the illustrations should be clear and readily recognised.

The opening chapters contain an excellent account of the Natural History of Insects and of the Natural Orders to which they belong. The key to the orders of insects mentioned is perhaps a trifle too elaborate for convenient use.

Each crop with its attendant insect pests is taken separately which is an excellent method and makes reference to any particular pest a simple matter.

Cotton receives careful attention and a concise description is given of all the chief pests. Here the illustrations of the scale pests are particularly indistinct and are hardly recognisable as such.

The Sugar Cane is treated in a complete manner and excellent accounts are given in all cases. The illustration of that important pest the Large Moth Borer is not as clear as it might be.

Cacao, Citrus Fruits, Coconuts, and Ground Provisions all receive attention.

Good accounts are also given of the insects which attack man such as mosquitos, fleas, bed-bugs, lice, etc. The Bête Rouge is mentioned though there seems to be some doubt as to its real identity. Mr. Ballou mentions them here as being species of *Trombidium*. It is an interesting point and one that requires further observations before an actual decision can be arrived at.

A useful section is devoted to the Insect Pests of Animals, and to insects troublesome in the household.

The book concludes with a very excellent account of insecticides and their application. A useful price-list of insecticides as sold in Barbados is appended. There is a final note on insect parasitism from the economic standpoint.

G. E. B.

Dry Weather and Mulches.

A dry season such as the present has the advantage of showing up the benefits to be derived from good cultivation—for instance, ground that was well worked after the rain and left with a loose earth mulch, so as to prevent evaporation, will show by the crops growing in it that there is still good moisture within reach of the roots; and, although maximum crops cannot be expected, the soil being loose will enable crops to take advantage of and benefit to the full by the first rain that falls. A glance at the Nursery block of young Para rubber trees on the Barron River clearly shows the good results to be derived from the loose soil mulch method; in fact, whenever this has been practised, crops, in spite of the long dry spell, are making fair growth, and have none of the stunted appearance so noticeable where the surface of the soil is hard.

—C. E. Wood (Manager, Kamerunga State Nursery) quoted in "Queensland Agric. Journal," December, 1911.

Meetings of the Board of Agriculture.

A MEETING of the Board of Agriculture was held on October 24th, 1911, His Excellency the acting Governor (Hon. C. T. Cox, C.M.G.) presiding.

Prof. Harrison presented to the Board a report by Mr. F. A. Stockdale, Assistant Director of Science and Agriculture, on cotton growing in the colony. In answer to Mr. Gaskin, who asked for a confirmation of the report that Sea Island cotton had been experimented with in the upper regions of the colony with some success, Prof. Harrison said Sea Island and other cottons such as had been experimented with in Georgetown had been sent to the interior at the time of the demarcation of the boundary, and had been planted by the Indians, but with no success. They had more than one variety of cotton now growing at the Botanic Gardens—hybrids between Sea Island and the native cotton.

RUBBER AND BALATA SUCCESSES.

Prof. Harrison reported the success of the colony at the International Rubber and Allied Trades Exhibition in London, at which the Consolidated Rubber and Balata Estates were awarded a silver cup for the best sample of Balata and Mr. Hodgson, of Pln. Noitgedacht, another for the best sample of cultivated rubber. He showed how plantations could be injured by having *Hevea brasiliensis* and wild Hevea rubber trees growing near each other: a state of things which would lead to the production of hybrids of *Hevea brasiliensis* and *Hevea confusa.* These hybrids, so far as they knew, would be of lower value as rubber producers than the true *Hevea brasiliensis.* He also pointed out that both the *Hevea brasiliensis* and *Hevea confusa* threw their seeds a great distance and that if both varieties of trees were growing near each other it was impossible to be sure of the purity of the seeds.

A VISITOR.

Prof. Harrison then introduced to the members of the Board Mr. G. N. Sahasrabuddhe, Government of India scholar for sugar, who was on a visit to the colony to study the growth and manufacture of sugar here. The visitor was welcomed by Mr. Gaskin on behalf of the Board. Mr. Sahasrabuddhe said he had received from Prof. Harrison and the planters all the assistance they could

give or he could desire. The Government of India saw the advantage of his coming here,—there being a reciprocity of interests between India and this colony—and sent him to acquire as much information as he could. He took the opportunity to dispel a little doubt as to the object of his visit by stating that he had come to the colony to study sugar manufacture and had no authority to inquire into the immigration system, and certainly had no leisure to do so.

INTERESTING COMPARISONS.

Prof. Harrison submitted the Board's annual report for 1910-11. This contained the different yields of rubber obtained in five periods of tapping of Sapium rubber trees at the Government reserve at Bonasica, which commenced in September, 1908, and in which they had the assistance of the Forestry Officer. Prof. Harrison further stated that the late Mr. Jenman had given to the Department an album of views of the Botanic Gardens taken in 1882. Another series of photographs had now been taken of exactly the same places, and it was proposed to have them framed so that the members could see the progress made by the Gardens during the last thirty years

SALES AT STALLS.

Mr. S. H. Bayley (acting Assistant Director) reported the number of plants sold and the money obtained for them at the Georgetown, New Amsterdam, Onderneeming, Pomeroon, Suddie and Morawhanna market stalls. The sales during the quarter were as follows :—Georgetown market stalls, 1,143 plants (chiefly cacao and coffee), realising $23.20 ; New Amsterdam, 1,922 (chiefly coffee and cacao , realising $32.56 ; at Onderneeming, 2,600 (chiefly limes and cacao), realising $33 ; at Pomeroon, 778 (chiefly nutmeg and coffee), realising $13.24 ; at Suddie, 44, realising $1.29 ; Morawhanna, 153 (chiefly coffee and cacao) realising $3.06. In spite of the dry weather the sales in Georgetown, New Amsterdam and Onderneeming were more, but at Pomeroon less, than the sales of the last quarter. These sales were independent of those of the Botanic Gardens. Prof. Harrison said that last year they sold about ten times the amount of economic plants they did in 1901 ; and at the Georgetown stalls alone, they had sold as many plants as the Gardens did ten years ago.

GRANTS TO SHOWS.

Prof. Harrison reported that grants of $120 had been made to the Agricultural Shows held at the West Bank and at Buxton ;

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Prof. Harrison presented to the Board a report by Mr. F. A. Stockdale, Assistant Director of Science and Agriculture, on cotton growing in the colony. In answer to Mr. Gaskin, who asked for a confirmation of the report that Sea Island cotton had been experimented with in the upper regions of the colony with some success, Prof. Harrison said Sea Island and other cottons such as had been experimented with in Georgetown had been sent to the interior at the time of the demarcation of the boundary, and had been planted by the Indians, but with no success. They had more than one variety of cotton now growing at the Botanic Gardens—hybrids between Sea Island and the native cotton.

RUBBER AND BALATA SUCCESSES.

Prof. Harrison reported the success of the colony at the International Rubber and Allied Trades Exhibition in London, at which the Consolidated Rubber and Balata Estates were awarded a silver cup for the best sample of Balata and Mr. Hodgson, of Pln. Noitgedacht, another for the best sample of cultivated rubber. He showed how plantations could be injured by having *Hevea brasiliensis* and wild Hevea rubber trees growing near each other; a state of things which would lead to the production of hybrids of *Hevea brasiliensis* and *Hevea confusa*. These hybrids, so far as they knew, would be of lower value as rubber producers than the true *Hevea brasiliensis*. He also pointed out that both the *Hevea brasiliensis* and *Hevea confusa* threw their seeds a great distance and that if both varieties of trees were growing near each other it was impossible to be sure of the purity of the seeds.

A VISITOR.

Prof. Harrison then introduced to the members of the Board Mr. G. N. Sahasrabuddhe, Government of India scholar for sugar, who was on a visit to the colony to study the growth and manufacture of sugar here. The visitor was welcomed by Mr. Gaskin on behalf of the Board. Mr. Sahasrabuddhe said he had received from Prof. Harrison and the planters all the assistance they could

give or he could desire. The Government of India saw the advantage of his coming here,—there being a reciprocity of interests between India and this colony—and sent him to acquire as much information as he could. He took the opportunity to dispel a little doubt as to the object of his visit by stating that he had come to the colony to study sugar manufacture and had no authority to inquire into the immigration system, and certainly had no leisure to do so.

INTERESTING COMPARISONS.

Prof. Harrison submitted the Board's annual report for 1910-11. This contained the different yields of rubber obtained in five periods of tapping of Sapium rubber trees at the Government reserve at Bonasica, which commenced in September, 1908, and in which they had the assistance of the Forestry Officer. Prof. Harrison further stated that the late Mr. Jenman had given to the Department an album of views of the Botanic Gardens taken in 1882. Another series of photographs had now been taken of exactly the same places, and it was proposed to have them framed so that the members could see the progress made by the Gardens during the last thirty years

SALES AT STALLS.

Mr. S. H. Bayley (acting Assistant Director) reported the number of plants sold and the money obtained for them at the Georgetown, New Amsterdam, Onderneeming, Pomeroon, Suddie and Morawhanna market stalls. The sales during the quarter were as follows:—Georgetown market stalls, 1,143 plants (chiefly cacao and coffee), realising $23.20; New Amsterdam, 1,922 (chiefly coffee and cacao, realising $32.56; at Onderneeming, 2,600 (chiefly limes and cacao), realising $33; at Pomeroon, 778 (chiefly nutmeg and coffee), realising $13.24; at Suddie, 44, realising $1.29; Morawhanna, 153 (chiefly coffee and cacao) realising $3.06. In spite of the dry weather the sales in Georgetown, New Amsterdam and Onderneeming were more, but at Pomeroon less, than the sales of the last quarter. These sales were independent of those of the Botanic Gardens. Prof. Harrison said that last year they sold about ten times the amount of economic plants they did in 1901; and at the Georgetown stalls alone, they had sold as many plants as the Gardens did ten years ago.

GRANTS TO SHOWS.

Prof. Harrison reported that grants of $120 had been made to the Agricultural Shows held at the West Bank and at Buxton;

the Secretary of the Buxton Show, however, had written to him saying that he wanted more and he had asked the Secretary to supply him with a balance-sheet of the Show and of the Society, because he did not think they would be justified in increasing the grant until they had exact figures. The documents had not turned up as yet, but when they came to hand he would circulate them amongst the members of the Exhibition Committee, and perhaps the Board would authorise that Committee to add to the grant if thought advisable. The grants to the Societies had been a little lower for the past two years because the Board relieved the Societies of all expenditure in connection with the School and Model Gardens. Mr. Maynard Payne proposed the following resolution which was carried unanimously :—"Be it resolved that in future no more than one prize be allowed to members of the same household or family in respect of exhibits of the same class unless such exhibits be certified under the hand of a villlage Warden, manager of a sugar estate, Commissary, officer of the Board of Agriculture or minister of religion as having been *bonâ fide* produced and obtained from land *bonâ fide* cultivated by the exhibitor individually."

Owing to the suggested affilliation of District Agricultural Associations, the Board had appointed a Committee of its members with representatives of the local Associations to go into the matter; this proved a very hard and difficult task and finally the members of the Board worked out a scheme which they discussed with the representatives of the District Associations. A copy was sent to every member of the Board of the proposals for the scheme which the committee suggested they should take action for under section 9 of the Ordinance but it struck the Committee in drawing up those regulations that the Board was not in any way connected with the various District Associations and could not very well command them. Mr. Bayley then proposed that all the books of any Association should be open at any time to the inspection of any officer of the Board authorised by the Chairman; and this was approved of by the Board.

DEMONSTRATION PLOTS.

A suggestion for the establishment of "demonstration plots," on selected farms was next considered by the Board. The idea was that they should get from some farmer who was in a good central position a certain amount of land and induce him to cultivate it on lines laid down for him by the Board. The farmer would receive a certain limited sum of money, but only on condition

that the land be cultivated in strict accordance with the instructions of the Board's officers, and be kept open for the inspection of anybody living in that district.

INSPECTORS AND FEES.

As to the question of the appointment of Inspectors under Ordinance No. 16 of 1910—the Cattle (Improvement of Breed) Ordinance—Prof. Harrison showed that it was a very difficult task. It was then suggested that the Board should approach the Government and recommend that authorisation to charge a fee be given to the Inspectors, and that such authorisation be provided for in the Ordinance by amendment.

ESTIMATES FOR 1912-13.

Estimates of the Board of Agriculture for 1912-13 were then laid on the table by Prof. Harrison. It was much the same as last year except in the case of the vote for the Botanic Gardens which was increased to include the maintenance of the D'Urban Park, and the Garden roads. The total amount estimated for was $14,570 as against $14,518 last year. The estimates were agreed to and Prof Harrison suggested that the Combined Court should be asked by the Board to include on the estimates for the Department a sum of money under no particular head which could be used for emergencies which might arise. This suggestion found favour with the meeting and Mr. Gaskin formally moved that a "contingency" vote of $1,000 be added to the estimate. This was carried. Prof. Harrison reported that the Executive Committee of the Board had filed the fees for the pasturage at the D'Urban Park:—for horses, asses, and cows, $1 each a month, and for sheep 16 cts. a head per month. They had prohibited the keeping of goats.

NEW BLOOD.

The Live Stock Committee recommended the following importations by the Board during 1912-13;—from Canada a pure-bred ram and Plymouth Rock fowls, and from the United States a Guernsey bull immune from Texas fever. It been recommended also that the Board should purchase a limited number of local cows for the Onderneeming School farm because the heifers imported from Barbados last year had not been satisfactory; and that they should import a fresh stock of buffaloes from India—two bulls and four heifers: a bull and two heifers for the Penal Settlement and a bull and two heifers for the Gardens,

MARCH 26, 1912.

A meeting of the Board was held on March 26th, 1912, at which His Excellency the acting Governor, Hon. C. T. Cox, C.M.G., presided.

Mr. Howell Jones applied for leave of absence in consequence of his having arranged to leave the colony, and acting on the suggestion of Prof. J. B. Harrison the Board requested His Excellency to appoint him (Mr. H. Jones) an honorary member. This motion was agreed to unanimously and Prof. Harrison suggested that if Mr. Jones accepted the position he should be asked to be the representative of the Board in England. This also was agreed to.

THE DEMAND FOR RUBBER SEEDS.

Prof. Harrison reported that he had orders for about 100,000 more rubber plants than he could supply. To cope with the demand they had written to the Straits Settlements requesting a supply of 150,000 seeds a year for the next five years. Hitherto they had only been getting 60,000 and they had to go elsewhere to get others. In obtaining Para rubber seeds it was of the utmost importance to know the source from which they came. The Government had approved of a system by which the Department of Science and Agriculture would test packages of Para rubber seeds imported into the colony (of not less than 500 and not more than 1,000), determine their rate of germination, examine the packing material and give such certificates as might be necessary.

RICE.

He also stated that they had been unfortunate in their experiments with rice last year, and so had not such a large quantity to distribute. They distributed 66 bags, each of 160 lb. The applications for seed paddy this year were far beyond anything they could deal with. East Indians and others seemed to have realised that the selected rices had merits of their own above the ordinary creole rice and that seeds grown by the Department's method were far preferable to the ordinary paddy. He thought it desirable that they should extend the production of rice of this sort seeing there was a pressing demand for it. Pln. Clonbrook might be utilized in this way.

SUGAR CANE.

Prof. Harrison reported that 164,690 cuttings of sugar canes had been distributed for the year 1911-12. In connection with the areas occupied by the principal varieties of seedlings during the current year, the Professor submitted statements.

It was remarked that there had been no success due to definite cross-fertilization anywhere, but it was rather early to expect that yet. A table was being prepared to show the results of all experiments in cross-fertilisation irrespective of area, and this would be published in the *Journal.*

SALES.

Mr. Stockdale reported as follows upon the sales of plants at the stalls in the colony:—

Georgetown, 4,203 plants sold for $84.94; New Amsterdam, 5,156; Pomeroon, 1,311; Suddie, 375; Morawhanna, 1,680; Onderneeming, 4,454. It was remarked that the sales of plants in February on account of the drought were very low; but even taking the drought into consideration the sales at the end of March would exceed the total sales of last year. The order in which the plants were in demand was as follows:—Georgetown, coffee, cacao; New Amsterdam, cacao, coffee; Pomeroon, coffee, cacao; Morawhanna, coffee, cacao; Onderneeming, limes; and the total sum realized was $310 32.

RUBBER AT ISSORORO.

Mr. Stockdale reporting upon the growth of rubber trees which had been planted four years ago in January, 1908, at Issororo Experimental Station, stated that the average measurements of all the trees in the lower section (Sapiums and Heveas) and on the hill beds compared very favourably with averages in Ceylon and in Malaya; on the hill beds the growth had not been so satisfactory and a good number of trees had died fom time to time. On a request from Prof. Harrison the felling of Sapium trees for experimental purposes was sanctioned.

THE AGRICULTURAL CONFERENCE.

Prof. Harrison submitted a report on the West Indian Agricultural Conference at which he and Mr. Howell Jones represented the Board and including reports by Mr. Leechman, Mr. Bodkin, Mr. Waby and Mr. Bayley. This report had been forwarded to the Government with a request for its publication. Mr. Bodkin, Government Economic Biologist, submitted a report on a visit to Trinidad, Barbados, and Dominica which he had made with the object of studying insect pests.

THE MODEL GARDENS AND SCHOOL TEACHERS.

Prof. Harrison drew attention to the way Model Gardens were being boycotted by teachers who prevented their children from

attending because they wanted them to go at a different hour from that on the time-table. After some pointed remarks by Mr. Gaskin and other members, His Excellency said that Nature Study or Agriculture should be made a compulsory subject in all schools, and failure in that should mean failure in other subjects. Until they had that they would never have a satisfactory system of education here.

With regard to the establishment of Demonstration Plots on selected farms the meeting approved of a start being made at Berbice when funds were available on the 1st of April.

Prof. Harrison reported that a Guernsey Bull had been imported from America at a cost of $318.72 ; and six buffaloes from India. They were also importing a Shorthorn for Onderneeming from America at a cost of $300.

Education in Country Schools.

Students of rural affairs have long realised that much dissatisfaction exists in country districts with our present system of education. In whatever way it is judged, according to its critics, it has failed ; the children sent out from the country schools are not better fitted for work on the land than their fathers were ; on the contrary, they are kept at desk work during the period when it is supposed that their respective faculties are at the best, and when they would, on the land, most rapidly learn the ways of animals, of plants, and of soils. Even the friends of the system will concede that it has been evolved without any special regard for country requirements, and without taking account of the fundamental differences in habits of thought and in points of view between the dwellers in the town and those in the country.

More and more it is being realised that the future development of the rural district, or to put it still more widely, of the country civilisation, must run on different lines from that of the city, and experiments are therefore being made to evolve a system of education that shall train children to lead the life of the country.

—"Nature" : Nov. 16, 1911.

Hints, Scientific and Practical.

Plants and the Soil. THE common idea that certain plants flourish only in particular soils because they find there some particular constituent which is elsewhere lacking is erroneous; we might almost say that all soils contain all the constituents that plants need, so that, as far as food goes, where one plant can grow any other should be equally possible. It is true that the excess or deficiency of certain soils in some particular constituent renders them more or less appropriate to one crop or another, but the circumstances which determine the association of a given plant with a particular soil are more often questions of texture, temperature, and water supply, than absolute nutrition, as represented by the greater or less provision in a soil of a particular constituent of the plant.

—A. D. Hall, M.A., F.R.S., in "The Feeding of Crops and Stock,"

Partial Sterilisation of Glass-house Soil and its Effects. 1. Partial sterilisation of soil increases the supply of food for the plant, somewhat alters the growth of the plant and kills insect pests.

2. It may cause a temporary retardation in germination and in early growth, the amount of which varies according to the nature of the soil, the seed, and the general conditions.

3. In our experiments it has not proved advantageous for pot work where abundant supplies of clean virgin soil and manure are available.

4. It is, however, very useful for work with borders, cold frames, and for plants that are to run for some time without manure. It leads to better root development, sturdier and healthier plants, earlier flowering, more prolific fruiting, and better quality of fruit.

5. It is particularly useful for commercial glasshouses where soil pests are a source of trouble, and soil " sickness " sets in.

6. At present the most effective method of partial sterilisation is to heat the soil to a temperature above 140° F., but not exceeding 212° F. Very satisfactory results have been obtained between 180° and 200° F.; ½ cwt. or less fuel is required per ton of soil; capital and labour charges depend on the speed at which the

process is to be worked. Our experiments indicate that effective chemical treatment is also possible, and would, of course, be much simpler, but we have not yet tested a sufficient number of commercial products to discuss the problem from the grower's point of view.

—E. J. Russell, D.Sc., and F. R. Petherbridge, B.A., in "The Journal of the Board of Agriculture" (England), January, 1912.

Water Culture Experiments.

We may now proceed to make use of the method of water cultures, to determine what are the mineral substances, etc., taken by the plant from the soil and which of them are essential to its growth. When dealing with the composition of the plant, we have already seen that a comparatively small range of elements are to be found there, and that all plants are alike in containing besides carbon, hydrogen and oxygen, also nitrogen, sulphur, phosphates, chlorine, and often silica, with potash, soda, magnesia, lime, and iron among bases. Only these elements can be essential to the plant: and whether all of them are necessary can be ascertained by growing a set of plants in water cultures and omitting from successive bottles each element in turn. Taking for example, in bottle 1 the standard solution which we have already employed*; in 2 the potassium nitrate may be omitted, thus giving a solution without nitrogen (the potassium will be still furnished by the potassium phosphate); in 3 the potassium phosphate is omitted, and we get a solution containing no phosphoric acid; in 4 the potassium phosphate and nitrate are replaced by the corresponding sodium salts; and so on. The seedling barley or maize plants are inserted in the usual way, with the result shown in the illustration† from which it will be seen that only soda and perhaps chlorine can be omitted without some injury to the plant. When either nitrogen, phosphoric acid, or potash is omitted,

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* Water	1 litre
Potassium nitrate ...	1 gramme
Magnesium sulphate ...	·5 "
Calcium sulphate ...	·5 "
Sodium chloride ...	·5 "
Monopotassium phosphate	·5 "
Ferric chloride ...	trace.

† Unfortunately we have been unable to reproduce this picture.—[Ed. J. B. of A.]

growth ceases as soon as the food supply in the seed is exhausted; in the absence of sulphuric acid, or magnesia, or lime, growth continues, though it becomes rather abnormal; but soda, silica, and sometimes chlorine can be left out without causing any difference to the growth. If no iron is added to the solution, the leaves of the seedling plant soon become very pale in colour; the new shoots in particular will be of a pale straw colour and possess no substance, until in a short time the whole plant perishes. But if a few drops of ferric chloride are added to the solution, on the following day the veins of the leaves will be seen to be turning green again, and the whole of the leaf will rapidly follow suit. In some way an iron salt is necessary to the formation of the chlorophyll—the green colouring matter of the leaf—without which no assimilation can take place.

—A. D. Hall, M.A., F.R.S., in "The Feeding of Crops and Stock."

The Influence of Science on Agriculture.

I HAVE confined these illustrations to such as show how we can materially increase the quantity of produce raised from the land by means of attention to plant-food, moisture, and seed. And, indeed, this at present is the fundamental task before us, a task which overshadows all others, but, as everyone acquainted with the subject knows, we might have drawn illustrations from every branch of agricultural practice. The improvement of our pasture lands, the cultural improvement of our native grasses, the improvement of our quality of our agricultural produce, more especially in regard to its value as food for man and beast, the improvement of live stock, especially of dairy herds, improvements in labour-saving appliances, improvements in attacking diseases and pests which prey on both plants and animals, improvements in factories and in processes for working up raw material, improvements in marketing methods, more especially as to export, improvements in social methods and organizations, all these present a most fertile field for the operations of that knowledge and trained common sense which we call science; and I have no hesitation in saying that, if all that science has discovered and has demonstrated to be practicable were being now applied to our agriculture in these various directions, the total annual wealth of this colony would be double of what it is at present.

How are we to bring about this result? How then are we to get this knowledge applied? How is the agriculture of a country to be brought under the control of science? This, at present, is not a question of agriculture, but rather a problem in practical psychology. It is mainly a question of getting new ideas into the minds of men. Some may call it a question of technical education but it is much more than that. It is a matter of getting a whole nation to feel the gravity of these facts, and of rousing the people into action. It is not simply a matter of driving new knowledge into the dense mind of a farmer. The farmer is not so stupid as he is sometimes made out to be. Once demonstrate to him that these facts are really facts, and that they are practicable and profitable, and his own self-interest will make him apply them so far as he can. The average farmer is not a genius, and he has his own hard work to attend to, and he cannot spare time or money to put to the test every new notion which may be preached to him. Probably in his early days he has tried some, and failed to get any good out of them, and has grown suspicious of all therest. But I have never yet found a farmer who could not recognise a profitable fact when it was presented to him with patience and tact, and by good practical demonstration. As a rule, farmers welcome and respect any man whom they feel to be a real friend with genuinely valuable knowledge to convey to them. But there is a great deal to be done besides coming into vital touch with the farmer's mind. What is wanted is for the people in the country to recognise that this is a really great work, and a work of pressing importance, which needs adequate provision for its due execution.

—A. N. Pearson (Victorian Chemist for Agriculture) in a Paper read before "The Australian Association for the Advancement of Science."

A Fern and its Lessons.

In the Rothamsted laboratory a sample of soil weighing several pounds was put away in a rather moist condition in 1874 in a gallon bottle, which it three parts filled. The bottle was corked, the cork waxed and covered with a lead capsule. A few years afterwards a fern, *Asplenium nigrum*, was noticed to be growing within the bottle, having developed from a spore which must have been present in the undried soil. This fern has continued to grow, and at the present time (1910) it occupies nearly the whole of the vacant upper part of the bottle,

No air can either enter or leave the bottle ; at first some doubts were entertained as to the impermeability of the sealed cork, but the whole of the cork and the neck of the bottle have been enclosed in a block of paraffin wax which was melted and cast on to its present position. The bottle stands on a low shelf in a building lighted from the roof : the illumination it receives is only good for a few hours on summer days, when a little direct sunshine reaches it. This illumination in the summer is, however, enough to enable the green fronds of the fern to decompose sufficient carbon dioxide to maintain its slow rate of growth, and also to give rise to the oxygen required by the plant for respiration throughout the whole year. Similarly the plant is always re-creating carbon dioxide by its respiration, and this carbon dioxide must be undergoing a perpetual cycle of change : it is split up by the plant in the light summer days, its oxygen being returned to the air and the carbon held by the plant, then in the darkness and the winter this change is more slowly undone again and the carbon dioxide reconstituted. Of course, in such a fashion the fern could never become any heavier—could not in fact have reached its present size—had there not also been another source of carbon dioxide within the bottle due to the slow decay of the organic matter originally present in the soil. The development of this enclosed fern with its quiet annual ebb and flow might be looked upon as a sort of perpetual motion machine, but we must not fail to recognise the fact that one external factor —the incidence of the light—is absolutely necessary to the process. It is this light, small as its amount may seem to be, which supplies the energy required to drive the machine. A plant is a storehouse of energy, of potential work ; given enough of the plant—a tree, for example—we can burn it under a boiler and drive an engine which will do work for us. To come a little closer, starch will burn when ignited and supplied with air or oxygen ; in burning it will give out heat, which can be made to do work. Clearly, then, starch and oxygen contain more energy than carbon dioxide and water into which they are turned by the burning process. In consequence, when a leaf turns carbon dioxide and water into starch and oxygen, it is, as it were, pushing something uphill, endowing the resulting product with more energy than the original material possessed, and since energy cannot be created *de novo* any more than matter can, this energy must have been obtained from somewhere outside the leaf. The energy required to effect the change is, in fact, obtained from the light ; the

green leaf simply acts as a kind of transformer of the energy coming from the sun in the form of light, into the stored-up energy possessed by vegetable material. Stephenson was absolutely right when he called coal "bottled sunlight" for the vitally important feature of the coal—its power to burn and give out heat, whereby it becomes a source of work—is all derived from the light which fell upon those early forests in which grew the vegetation that nowadays is preserved as coal. The plant is not a very efficient transformer of the energy of sunlight, because it only picks out and utilises a very small selection from the numerous rays making up the light: according to Dr. Horace Brown's researches, the leaf only succeeds in utilising for the manufacture of starch about $\frac{1}{1000}$ of the energy of sunlight and $\frac{1}{60}$ of ordinary diffuse daylight. Small as this utilisation of the sun's energy may seem to be, we must fail to realise that in the assimilation of the green leaf we see at work the only great upholding process, by which energy is caught and stored, that can be recognised as going on in the world. The life of an animal is a down-grade process depending upon the burning up in respiration of materials which have been previously built up by the plant, and though the animal cannot destroy the energy that was present in his food, he transforms it into low-grade forms which are not longer utilisable. Decay and burning are similarly destructive or down-grade processes, and just as the life of the animal is absolutely dependent on the preliminary life of the plant to build up its necessary food, so for our engine-power we are largely living upon irreplaceable capital stored up in the coal and oil that were manufactured in earlier stages of the world's history.

—A. D. Hall, M.A., F.R.S., in "The Feeding of Crops and Stock."

Dangers of the "Chopping Habit."

I would like to call your attention to the passage on page 8 relating to *Aspidiotus destructor*, or the coconut scale. There appears to be a relation of certain ants to the scale by which the latter are protected and so are apt to increase in numbers. The ants are greatly encouraged by the numerous cutlass chops on the trunks of the coconut palms, and in the Cedros district I noticed that nearly every cutlass scar on many trees contained a colony of the ants. Would it be possible to impress on coconut pickers that trees are not to be used as temporary stands for their cutlasses?

—"Bulletin Department of Agriculture, Trinidad and Tobago," December, 1911.

Visits to Country Districts.

ONDERNEEMING.

The Director and Agricultural Superintendent have visited Onderneeming Industrial School and have inspected the various experimental cultivations. The cacao is in satisfactory condition and the limes are promising. The drought has affected much of the cultivation, but the cacao plots appear to be holding out well. Improvement of the drainage has been undertaken and preparation of that portion assigned for the Agricultural School has been commenced. The Live Stock has suffered through shortage of pasturage but is in good health.

CHRISTIANBURG.

The Assistant Director and Agricultural Superintendent visited Christianburg Experimental Station, and inspected the rubber cultivation and other plants. The new extension near the river appears to be promising, but on much of the lighter soils which were first planted the rubber trees have of late made but slow growth. It is possible that this has been occasioned by the severe drought, but with the rains it is intended to plant up extensive leguminous and other cover crops.

ISSORORA.

The Assistant Director has visited Issorora Experiment Station in the North Western District. The oldest sections of this Station planted with *Hevea brasiliensis* and *Sapium Jenmani* is in good condition. The trees have continued to make good progress and are healthy and vigorous. This section has now been planted for four years, and the average girth measurements of all the Heveas, whether original plants or supplies, is 12½ inches and that of the Sapiums 20½ inches. Over one-fifth of the total number of Hevea had attained a girth masurement at three feet from the ground of over 15 inches and tapping experiments are to be commenced when the rains begin. Tapping experiments with Sapium Jenmani will also be undertaken . Considerable shrinkage of the soil in section D has taken place, as the result of drainage and cultivation, and it seems probable on pegassy-clay soils of this character that it would be better to have the drains dug immediately after the forest is burnt off, and then to have the area planted with one provision crop previous to planting out the

rubber. Through the shrinkage of the soil in this section, several trees now have their main roots exposed, and it is hoped by having drainage laid out at least a year before planting with rubber, this may be obviated. Section A, B and C, the experiments in which have come to a conclusion, are being cleaned and drains dug previous to planting up on the same system as adopted in section D. The trees of the hill slopes have made a certain amount of progress, but the growth has been slower than on the flat pegassy-clay soils. *Funtumia elastica* and *Castilloa elastica* have grown better on the hill slopes than on the flat lands. The New Extension, Section 1, has been planted up and fair growth is being made, but some supplying will have to be done. Trials have here been made with different kinds of coffee between the rubber and with leguminous cover crops. The New Extension Section 2 has recently been planted up with Para rubber, and with different provision crops. Section 3 of this extension has been cut down and will shortly be burnt off. Advantage has been taken of the dry weather to thoroughly overhaul the whole of the drainage system of the Station, and in getting the weeding well forward. Many of the four-year-old Para rubber trees were in full flower, at the time of this visit and it has since been reported that some are setting fruit.

PLN. NOITGEDACHT.

The Assistant Director has also visited Pln. Noitgedacht and inspected the rubber trees that are being tapped there. These trees have been tapped throughout the whole of the drought, and excellent rubber has been obtained. The yield of latex has been much less than in the rainy season, but the percentage of rubber has been higher. The rubber was of good colour, strength and elasticity.

EAST COAST, DEMERARA, AND CANALS.

Visits have also been paid by the Agricultural Superintendent and other officers of the Department to several estates on the East Coast of Demerara and on Canals 1 and 2. Diseases of coconuts are being investigated in the field and laboratory. At Mahaicony what appears to be a fungus disease of the nuts seems to be prevalent, and bud-rot is not uncommon in some districts.

Bad drainage and improper cultivation account for the loss of many trees. The drainage and cultivation should receive careful attention, and all trees that have died, no matter from what cause, should be cut down and destroyed : otherwise they are a

menace to the cultivation. Coconuts respond wonderfully to careful cultivation, and it is to be regretted that practically no proper attention is given in this colony to this matter. With careful cultivation the yields are increased and the size of the nuts is improved. In several cacao estates a large number of trees have died during the dry weather. This in some cases has been traced to canker, which should receive attention. Advantage is being taken of the dry weather to improve the drainage of some coffee and cacao estates. The side lines are being dug and the small bed drains are being cleaned and graded. Without good drainage neither cacao nor coffee can thrive.

F. A. S.

The Danger of Domestic Filters.

"Domestic filters are probably more often a source of pollution of the water than otherwise. It is usually considered that a filter requires no attention; it is consequently but rarely cleaned; the filtering material is seldom renewed and its pores become clogged with putrescible organic matter, which forms a suitable nidus for the growth and development of living organisms which contaminate the filtered water. It is not unusual under such circumstances to find a considerably larger proportion of organic matter in the filtered water than was present before filtration." These remarks are especially applicable to so-called gravity filters in which the filtering material is composed of vegetable or animal charcoal, sand, spongy iron, magnetic carbide of iron, polarite and carferal, the latter substance being a mixture of iron, charcoal and clay. It should be distinctly understood that there is no such a thing as a self-cleaning filter, and even the Pasteur-Chamberland, Berkefeld and filters of the type in which the water is passed under pressure through hollow porous procelain cylinders require periodical cleaning at short intervals by a hard brush—otherwise bacteria may in time grow through the cylinder and appear in the effluent; while it has been shown by Dr. Horrocks that though typhoid organisms are not able to grow through the walls of the Pasteur-Chamberland candle, they can grow through the walls of the Berkefeld candles "probably owing to the larger size of the lacunar spaces" and hence the Berkefeld candles should be sterilized in boiling water every third day. On the whole, we may conclude that it is clearly the duty of every community to supply a pure wholesome water, so that domestic filtration may not be necessary.

"Science," October 20, 1911.

Agricultural Instructors' Reports.

UPPER COURANTYNE.

Mr. Instructor Augustus, in his report on the Upper Courantyne River, reports that the Somerville and Hephzibak districts appear to be well suited for lime cultivation, but that cacao does not appear to thrive. The farms from Canoacaboory Creek to Tiger Creek are in many instances in very good order and many of the farmers are paying special attention to the planting of permanent crops through their provision fields. A good deal of attention is being paid to the cultivation of cacao and some of the young fields are distinctly promising. In some instances witch-broom disease was prevalent and instructions as to its treatment were given. There is also a demand in this district for coffee, nutmeg and fruit plants. The drainage of many of the farms is in fair order, but improvement can be made in this direction. Pruning is also not thoroughly understood and it is hoped that good will result from the practical demonstrations given in the proper pruning of cacao and coffee cultivations. In some cases the trees are planted too closely together and shaded too heavily. A few trees of *Hevea brasiliensis* have been planted near Susan Creek but they have not made much progress. Instructions were also given as to the proper methods of planting up permanent crops in provision fields. The general practice at present is to take off three or four provision crops before putting in any permanent plants and it is hoped that this practice may be changed.

BERBICE RIVER.

The farmers at Light-town, Mr. Augustus reports, have followed instructions in regard to the proper digging of drains and they are planting permanent crops, chiefly cacao, through the provisions. At Schumacker's Lust and La Fraternité the farms are in good order but the drainage is still poor. The farmer's attention has been directed to this defect.

RICE AND THE DROUGHT.

Mr. Augustus reports that the farmers have been preparing their lands for rice at Liverpool, Manchester and Kildonan, but that the dry weather had prevented any sowing being done. He was pleased to report that better cultivation of the rice lands is being undertaken, good dams are being formed and the drains are being dug and graded.

IMPROVEMENT IN THE NORTH-WEST DISTRICT.

Mr. Instructor Abrahams reports from the North Western District that now that the rubber options have expired, farmers are paying careful attention to their cultivations. The drainage has been carefully attended to during the dry weather and many of the grants are now in very good order in this respect. He is also pleased to report that fields are being divided into sections, each section being planted up with a distinct provision crop. The rotation of crops is being appreciated, and the old practice of growing many different kinds of plants, such as corn, yams, plantains, tannias and eddoes, etc., mixed together in the same plot is gradually being abandoned. The provision crops planted amongst the new extension of Issorora Rubber Experiment Station are serving as good examples and as useful object lessons. The cultivation of permanent crops is not as extensive in this district as it should be, but there are evidences that the farmers are beginning to pay more attention to the cultivation of such crops as coffee and cacao. Coffee appears to promise well in the district, especially the Liberian kind. Attention is being given by the Instructor to such matters as distances of planting, pruning, etc., of this crop. Cacao grows well in some parts, but does not thrive where the land is of too pegassy a nature, and cultivators are advised to choose their land carefully for this crop. The growth of *Hevea brasiliensis* in this district has been satisfactory during the year, especially when the soil is of a clayey character. A good area of corn is being cultivated and the corn smut (*Ustilago maydis*) is reported to be much less prevalent than it was in 1910, now that precautions have been taken by the farmers against the disease.

POMEROON.

Agricultural Assistant Matthews, stationed at Marlborough, Pomeroon, has visited a large number of grants in the Pomeroon and the Moruca district. He reports that the drainage conditions are in need of improvement practically throughout the whole district, and on very few of the grants can the drainage be said to be good. Ground provisions are cultivated on most of the grants and the cultivation has generally been found to be in a satisfactory condition. There is, however, a tendency to allow grass to grow freely. Better results would be obtained if weeding was more carefully carried out, and especially if efforts were made to fight paragrass.

DISEASED PLANTAINS.

Plantains are on many grants diseased and considerable losses have taken place. On those grants where disease is the worst,

the drainage is not in satisfactory order and little or no attention has been given to the selection of suckers. Mr. Matthews reports that he is endeavouring to persuade growers that suckers for planting purposes should be carefully selected, and that they should be strong and vigorous and taken from plants which are free from disease. Too little attention is paid to the selection of plantain suckers throughout the whole colony. Other efforts are also being made to control the spread of this disease of plantains.

NEED FOR PRUNING OF COFFEE.

Arabian coffee does not thrive in the Pomeroon district, but Liberian does well. This last variety is healthy and yields good crops but too little attention is being paid to pruning. Suckers are allowed to grow and many of the bushes are much too dense to bear good crops. More attention is now being paid to the proper spacing of Liberian coffee and less overcrowding is now noticeable. Mr. Matthews reports favourably on the growth of Robusta coffee in this district.

CACAO AND LIMES.

Cacao is not largely cultivated in the Pomeroon, but on some lands it does well where good drainage is provided. A red kind of cacao is said to be the hardiest and least liable to disease. This appears to be a cross between Forastero and Criollo, and is said to yield well . Two acres of limes have been planted in one grant in the Moruca and are said to be progressing satisfactorily.

COCONUTS.

Coconuts have been planted in many places. They do not succeed, especially where the drainage is not of the best, and disease is common. Mr. Matthews traces this to improper drainage and insanitation on the farms. On one grant disease is being kept in control, and notes are being made throughout the district on the different kinds of coconuts that exist and on their freedom or otherwise from disease.

F. A. S.

Answers to Correspondents.

F.A.S. (Botanic Gardens).—The scales sent for identification attacking the Water Coconut (*Nipa fruticans*) were *Lecanium tessellatum* (Sign) var. *perforatum* (Newst). They are found on palms generally and have a wide distribution including France, England (Hothouses), Australia, Mauritius, Hawaii and Ceylon. Green records them in his "Coccidæ of Ceylon" and distinguishes them from a closely allied species found locally which he terms *L. subtessellatum*. They occasionally occur in large numbers and are then responsible for Black Blight.

The beetles attacking the trunks of dead rubber trees are Longicorns—*Orthomegas cinnamoneus.* They are comparatively common.

The larvae sent are a species of *Automeris*; they pupated soon after arrival and on emergence of the imago indentification can be made.

The larvæ feeding on the Almond tree have been identified as those of a moth—*Megalopyge nuda.* Bred in the laboratory they pupated for 31 days in a cocoon formed of their hairs and silk.

A. L. (Georgetown).—The larvæ sent for identification attacking young Hevea trees were those of the Hawk Moth, *Dilophonota ello,* previously recorded as attacking rubber. Three perfect insects emerged, one male and two females. These larvæ are capable of changing their colour in accordance with their surroundings; they also imitate cleverly the characteristic appearance of a young rubber stem. They were practically fully grown when received, feeding for a short time on some Sapium leaves that were given them. The pupal period was 15 days. When about to pupate they bit off all available leaves close to the stem, undergoing metamorphosis beneath the covering thus afforded. The pupæ themselves were light chestnut brown in colour with darker markings, 5.2 cms in length and 1.8 cms. in breadth.

H. L. H. (Nonpareil).—The two moths you sent down were *Megalopyge lanata,* a male and a female. Whether the larvæ are capable of feeding on rubber leaves or not has yet to be proved. If so this is the first record. They usually feed on a variety of plants, guava being one of the chief. The female deposited a number of eggs and the young larvæ as soon as they hatch will be tried with Hevea leaves. Owing to their conspicuous appearance

they are never likely to become a very serious pest. The hairs are generally supposed to be poisonous.

C. (Georgetown).—The "Curious-looking object" you sent was the sac of one of the "Bag Worm Moths" (*Psychidæ*). The larvæ builds for itself a silken sac covered with little twigs within which it lives. Locomotion is effected by the larva pushing out the front part of its body from the sac and creeping along carrying its "house" with it. When fully grown it fastens its sac to a twig and changes into a pupa. The females are wingless and never leave the sac, but are fertilised by the males (which are winged) in this position. The eggs are deposited within the sac. There is a curious superstition in Ceylon with regard to this family of moths. The natives there firmly believe that they are in reality human beings who in a previous incarnation were guilty of stealing kindling wood. Now they atone for their theft by repeating the act as an insect.

The Capitalisation of Honesty.

"Capitalisation of honesty" has been the keynote which has brought success to co-operative banking. By virtue of the circumscribed area in which each society operates, the management is able to gauge correctly the character of the applicant and the purpose for which the loan is to be applied. The result has been that the losses have been practically *nil*. There is also a moral side to the question. In many districts where the banks were opened the people were ignorant and unreliable, but the establishment of the local bank in which they were all interested has raised them to a higher standard of life. They were put on their honour and responded. Thrift has been encouraged with beneficent result. A current saying is "Whoever sets up Raiffeisen banks pulls down workhouses." Prompt payment of interest is insisted upon. When dealing with this matter H. W. Wolff, the leading authority on Agricultural Banks, writes :—

"The Bank will forgive anything rather than unpunctuality or remissness in this respect. And the effect which such strictures has in training men to business habits is remarkable. Should the borrower fail to apply the money as was stipulated, without hesitation or mercy the loan is called in within four weeks' time, the sureties being made responsible."

—"Journal Department of Agriculture," Victoria (Australia), December, 1911.

The Model Gardens.

Record of Attendances.

Below is given a table setting out the number of pupils who :tended the Model Gardens of the colony, arranged in quarterly eriods from April 1, 1907. These quarters (recorded below as st, 2nd, 3rd and 4th) run from January 1 to March 31; April 1 o June 30; July 1 to September 30; and October 1 to December 31. The totals only during 1907 and 1908 are given; the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd to 4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
1st to 4th	5,447	3,386	1,477	887	1.053	160	...	...	...	12,410
1909.										
First	1,638	710	338	463	370	302	...	...	...	3,821
Second	1,707	677	329	142	288	446	...	...	...	3,589
Third	¶1,252	742	433	436	172	378	223‖	...	...	4,636
Fourth	1,876	536	438	236	362	771	439	...	...	4,858
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	¶1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745
1912.										
First	1,127	379	1,374	1,034	425	207	573	359	423	5,901

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instructior given by the Superintendent Teacher. It has not yet been founc feasible to keep reliable, full records of the very numerou attendances during his absence.

¶ Schools in vacation during August.

‖ Instruction commenced in Jul

§ Instruction commenced in Apr

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to March 30, (1912). The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1909	1910	1911	1912.
Sugar, tons ...	27,099	20,000	13,866	15,282
Rum, gallons ...	607,135	575,652	331,639	902,210
Molasses, casks ...	57	445	179	...
Cattle-food, tons ..	2,379	2,131	2,020	1,566
Cacao, cwts. ...	20	118	59	·5
Citrate of Lime, cwts.	3	70	...	...
Coconuts, thousands	134·5	115·5	216	716·5
Copra, cwts. ...	123	65	425	710
Coffee, cwts. ...	600	344	269	469
Cotton, lbs. ...	...	.	...	...
Fruit, brls. and crates	...	...	..	...
Ground Provisions, value	..	$16	...	...
Kola-nuts, cwts. ...	...	...	...	...
Rice, tons ...	1,084	1,650	701	1,136
Rice-meal, tons ...	382	460	124	531
Starch, cwts. ...	...	..	..	...
Cattle, head ...	115	259	181	141
Hides, No. ...	742	1,362	1,414	722
Pigs, No. ...	108	266	196	242
Poultry, value... ...	$ 3 12	$ 16 68	...	..
Sheep, head ...	...	6	18	6
Balata, cwts. ...	486	488	647	212
Charcoal, bags ...	22,708	17,612	17,778	18,544
Firewood, Wallaba, etc., tons ...	2,201	2,166	2,557	..
Gums, lbs. ...	...	192	787	446
Lumber, feet ...	6,606	32,182	104,321	46,073
Railway Sleepers, No.	1,000	. .	1,000	1,556
Rubber, cwts. ...	7	7	4	1
Shingles, thousands	194	380	929	207·5
Timber, cubic feet	99,920	78,451	58,096	63,286

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